Compressed Air Magazine

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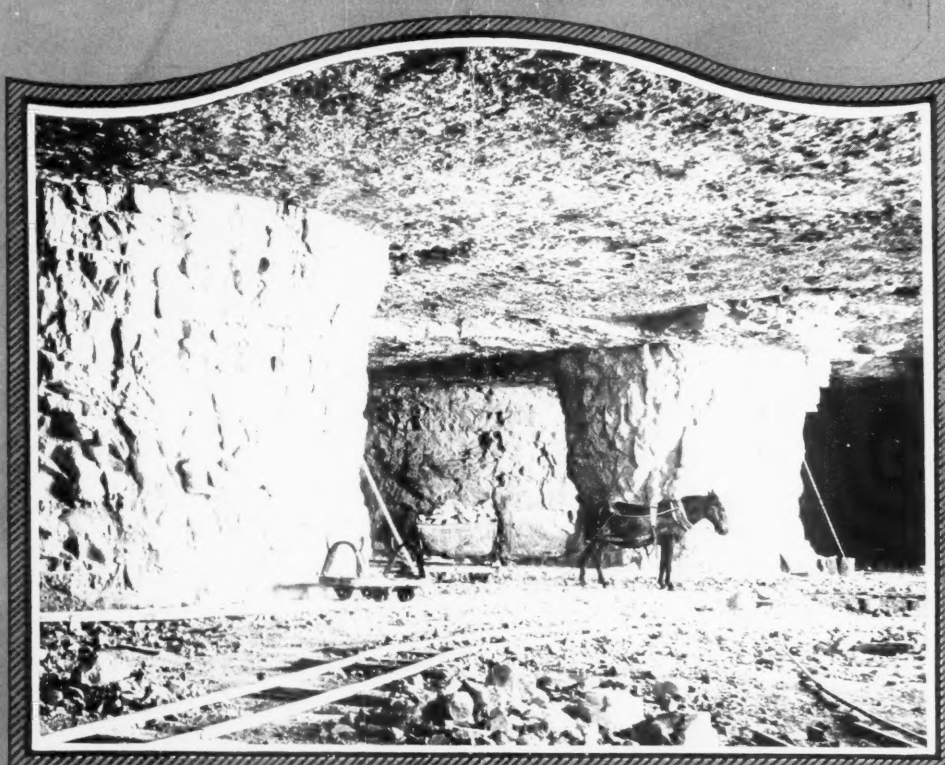

MINING LIMESTONE BY THE ROOM-AND-PILLAR METHOD HAS PROVED HIGHLY SUCCESSFUL AT AN ERSTWHILE QUARRY IN MISSOURI

Quarrying Marble in Rumania
J. Bibel

Heavy-Oil Engines and Their Uses
H. A. Pratt

Compressed Air Aids Foundry
R. G. Skerrett

Harnessing the Gatineau River
R. C. Rowe

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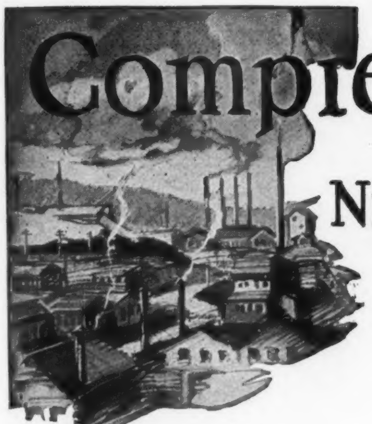


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VOL. XXXII, NO. VIII

AUGUST, 1927

Compressed Air Aids Foundry To Turn Out More and Finer Castings

Pneumatic Tools Make It Possible To Qualify Men Quickly For Exacting Work

By R. G. SKERRETT

UPON the work of the foundry depend many departments of industry. The foundry casts to form metal products weighing from an ounce to many tons in order to satisfy a multiplicity of demands.

The modern foundry must be able to work rapidly and to turn out castings in large quantity and of excellent quality. Men must be available to do this necessary work. To qualify the foundry force used to be a matter of long training; and skill came generally only after a protracted period of experience. Present-day conditions compel a much shorter training even while requiring a high standard of workmanship.

The accompanying article reveals how air-driven tools or equipment render it feasible to take inexperienced hands and make them capable and skillful in the foundry within a relatively brief span.

SOLOMON'S Temple owed no small part of its reputed magnificence to the skill displayed in producing some of its imposing castings. Those castings were wonders of workmanship; and their fineness was mainly due to the cunning of that master of the founder's art, Hiram Abif. In the truest sense of the term, the foundryman has, therefore, long been considered a craftsman; and the excellence of his work has very properly been attributed to a period of exacting apprenticeship and then to years of steadily ripening experience and increasing dexterity and skill.

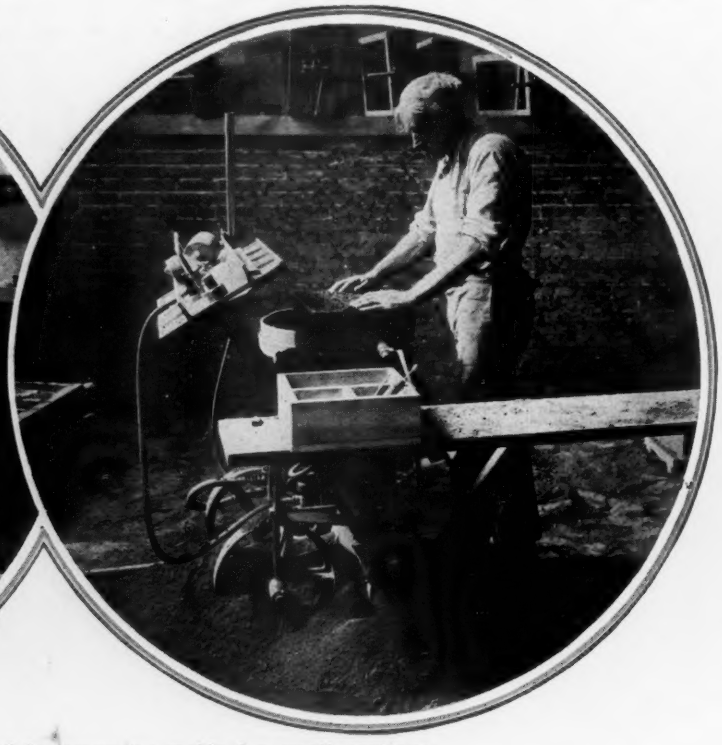
The prevalence of this regard is amply warranted, because for centuries metals were given their primary form mainly by the foundryman even though they were afterwards modified in producing the finished product. Decade by decade, especially in the last 100 years, the work of the foundryman has been greatly amplified and has grown proportionately in its industrial significance. This is understandable in view of the thousands of forms castings take today and of their extensive range in size, weight, and complexity. Notwithstanding the efforts that have been made to produce castings by strictly mechanical processes, still castings of this sort meet only a relatively small percentage of the demands. Quantity production depends upon handwork in the main, even though mechanical facilities are utilized to lighten labor and to speed up output in some particulars. Therefore, such of our readers as are unfamiliar with the subject may marvel how castings are made in quantities and of varied descriptions to provide for the multiplicity of uses and services to which such products are now put.

The purpose of this article is to outline the manner in which compressed air is used in up-to-date foundry work, and to tell how the employment of this form of energy or motive medium aids in turning out thoroughly excellent castings at a comparatively rapid rate. Furthermore, to explain how the utilization of compressed air makes it feasible to recruit the foundry force from sources that once would not have been considered likely to furnish a personnel capable in a few months of doing first-class work. Again, compressed air and pneumatic facilities not only greatly shorten the training period but their uses enable a willing and intelligent person soon to become a skillful one.

What follows is a broad outline of the activities of a foundry, carrying about 350 persons on its pay roll, that forms an integral part or department of a large engineering concern engaged in turning out high-grade machinery of different kinds. The castings made in this foundry vary in weight from 1 ounce to 10 tons; and this range of weight is a fair index of the varied nature of the output and likewise of the skill that must be exercised by the men on the foundry floor. The plant is equipped with two cupolas, each of which can melt 18 tons of metal an hour; and it produces an average of 60 tons daily, although it is possible to turn out 100 tons of melt a day.

Of the total force, about 30 are engaged in the pattern shop, while 14 others form a night shift. The foundry started on July 5, five years ago; and at that time but few of the personnel were experienced foundrymen. With this nucleus of experts it was found possible to recruit the rest, and by far the larger part of the force, from youths drawn from the neighboring farmlands—the foundry being located in the heart of an agricultural district long under cultivation by native-born tillers of the soil.

These farm lads promptly displayed aptitude; and it took but a relatively brief while for them to master the difficulties of the calling and to prove themselves capable of executing the most exacting work assigned them. Substantially all jobs are on a piece-work basis; and to be paid the worker must turn out a satisfactory job. It is interesting to recall that it is the exception when the work does not measure up to the high standard set. There is in evidence a spirit of friendly competition and,

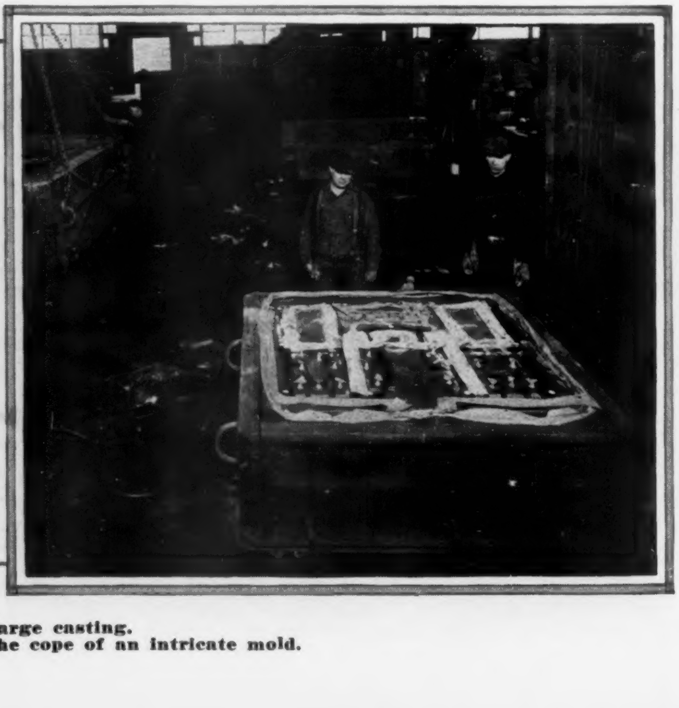
Pneumatic jarring machines used in preparing molds for small castings.

withal, a notable degree of comradeship that expresses itself in readiness to help one another on the foundry floor.

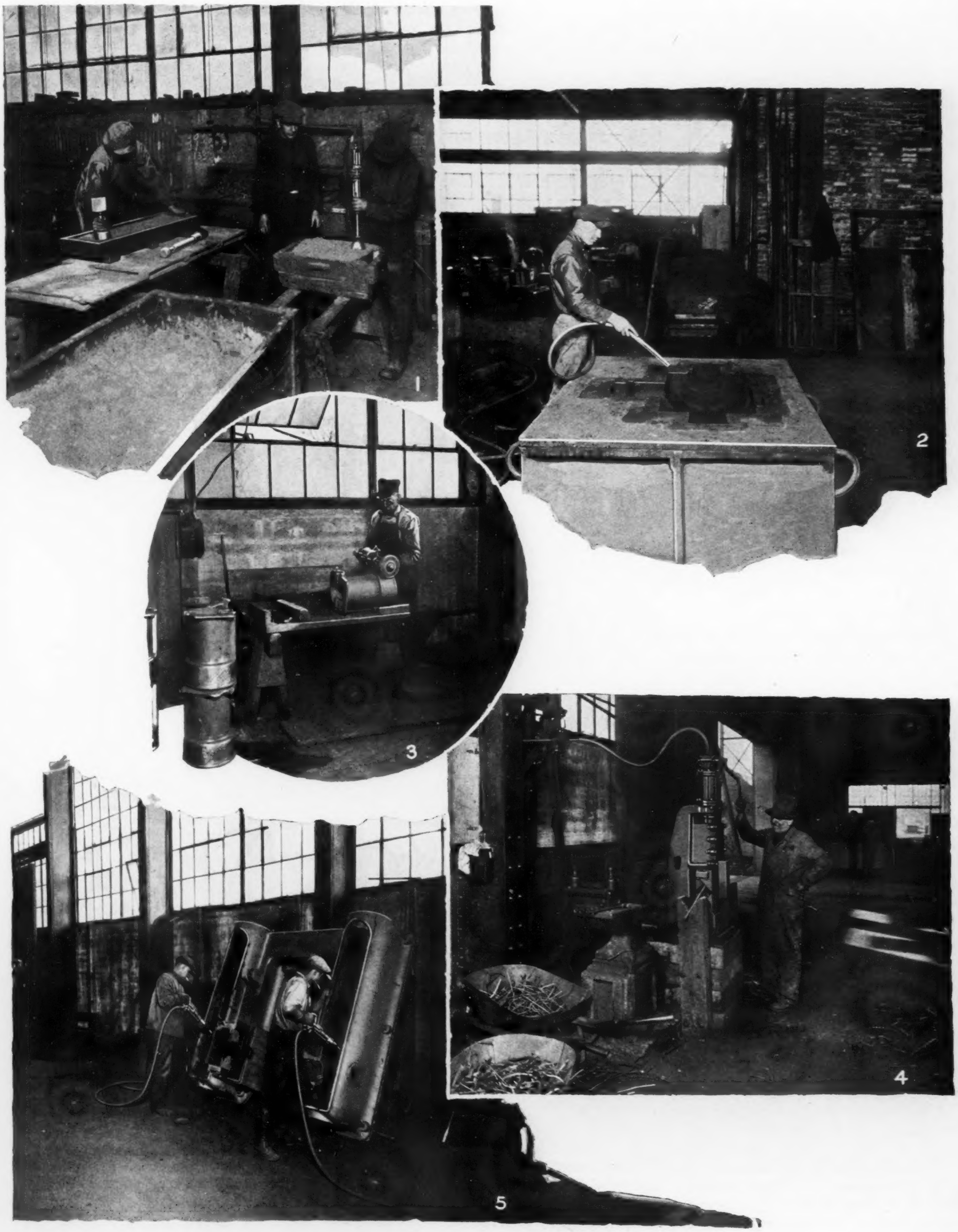
The compressed air used in the foundry is delivered to it through a buried 5-inch main 3,500 feet long. There are two wells or water traps in the line to take care of condensation at all seasons. This air originates in the main power plant of the factory; and the air reaches the foundry at a working pressure of 100 pounds to the square inch.

In ramming the cope and drag halves of molds, most of the work—both on the floor and on the bench—is done with air-driven sand rammers. In preparing a dry-sand mold, especially when the casting is to be a large and often an intricate one, it is essential that the sand shall be rammed as solidly as possible before the mold is baked so as to add just that much more to its stability. Here it is that the pneumatic rammer shows to greatest advantage, because it enables the foundryman to do his work well and quickly and to attain a measure of uniformity in packing the sand that could not be obtained by hand without much greater experience. Not only that, but ramming sand by hand is fatiguing; and in the case of a large mold this muscular weariness leads to a lack of uniformity in the mold and possibly to a defective casting if the pressure of the molten metal displace or move the sand.

Apart from packing the sand more firmly, one man using a pneumatic rammer can do as much work in a given interval as 3 or 4 men ramming by hand. This is a matter of considerable moment when the desire is to turn out a large number of identical machinery parts in the shortest time consistent with the making of thoroughly satisfactory products. The pneumatic rammer is equally valuable in ramming a green-sand mold, in which the aim is not to pack the sand as solidly as possible but to leave it just porous enough to permit the escape of steam and gas generated when the hot metal penetrates the cavities of the mold. If the green sand is packed too hard it is likely to confine the steam and gas until they attain a pressure that may act explosively and

Left—Finishing the core of a large casting.
Right—Drag ready to receive the cope of an intricate mold.



1—Using air-driven bench rammers on molds for small castings.
2—Blowing a drag free of loose sand with a jet of compressed air.
3—Finishing off surfaces of cylinder castings with a pneumatic grinder.
4—Pneumatic press straightening core rods for re-use in the foundry.
5—Breaking out cores in a machine frame with air-driven core breakers.

disrupt the mold and ruin the casting. The blow of the pneumatic rammer can be nicely tempered or controlled so that a green-sand mold may be packed just right and quickly.

What used to be a troublesome, and at times tedious operation—that is, cleaning out sand that may have fallen into a mold when withdrawing the pattern, is now done easily and in a few seconds by a jet of compressed air which speedily blows the intruding sand out of the way. Similarly, compressed air is used to blow the liquid facing on to mold surfaces. This facing or blacking is often mixed in the containing tank or tanks with agitating air; and in the long run this method of mixing is more satisfactory and more economical than when the work is done either by a power-driven paddle or by hand.

In the making of molds for smaller castings that must be turned out in large quantities, the practice is to utilize jarring machines that are operated with compressed air. These machines pack the sand by a combination of squeezing and vibrating actions; and they are so designed that they can roll over in order to pack successively the drag and the cope halves of a mold. The vibratory action also serves to loosen a pattern so that it can be withdrawn after the sand has been packed about it. As would naturally be expected, these machines insure a notable degree of uniformity in the compacting of the sand and contribute, accordingly, to the production of a high percentage of sound and perfect castings.

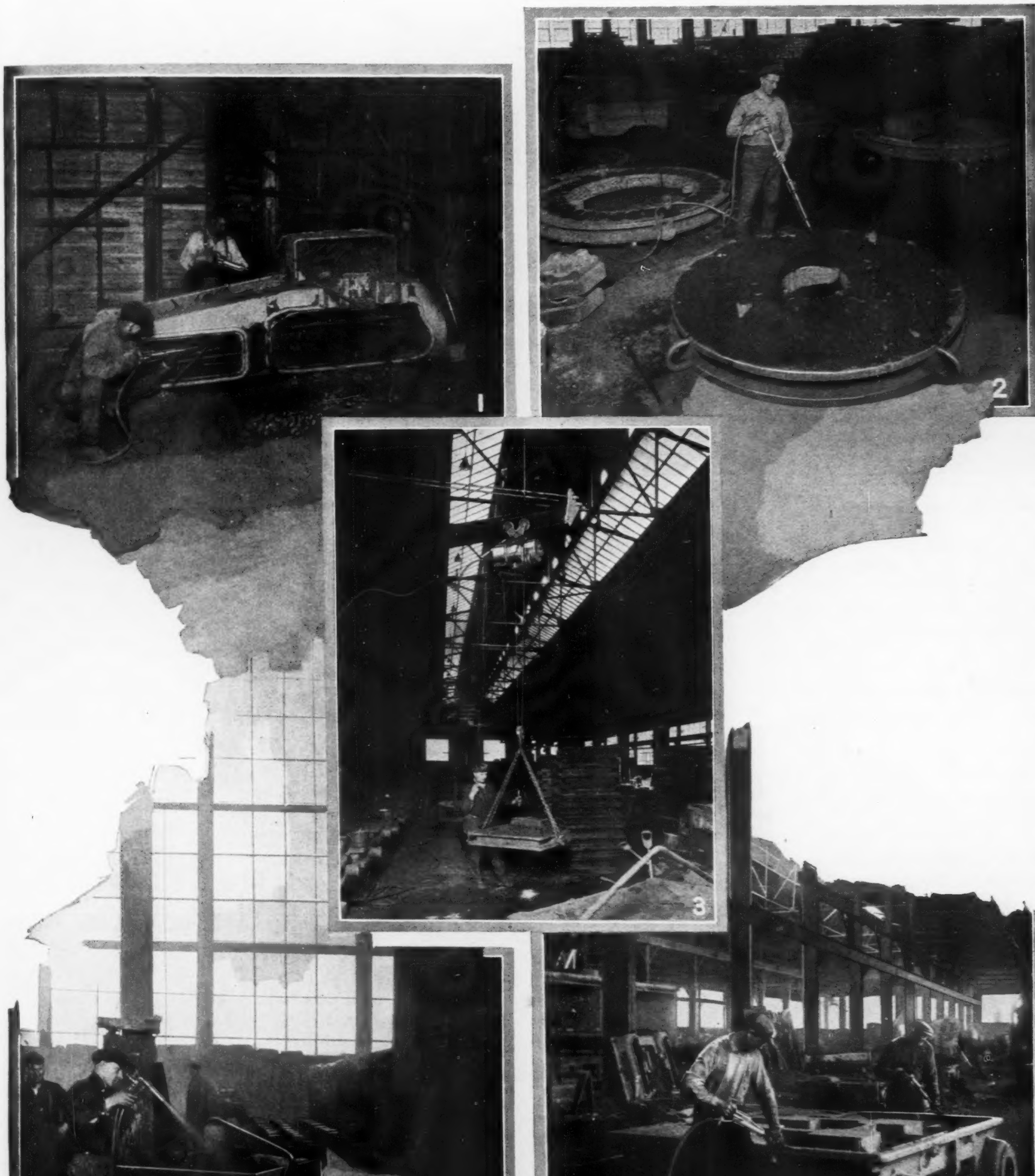
Pneumatic jarring machines make it possible to use partly skilled and even unskilled labor in turning out first-class work. In addition to this advantage, it has been found, after much experience, that with jarring machines the pattern upkeep is not even 25 per cent. of what it would be if the molds were hand rammed.

In handling molds and in doing other essential lifting on the foundry floor the air hoist has proved generally superior, not only because the air hoist lends itself to nice control, but because it can raise and lower a weight without jarring and can do this in much shorter time than the operation could be performed by a chain hoist of equal capacity. Furthermore, the air hoist is not affected by heat and dust as would be an electric hoist exposed to the same conditions; and an air hoist admits of a finer adjustment of speed.

In the production of castings of many kinds it is necessary to have recourse to cores of various shapes and sizes for the purpose of producing cavities or openings in the ultimate castings. As a rule, the large cores are handmade, but the smaller cores—especially when such are required in considerable numbers—are usually turned out with air-driven core-making machines of one sort or another. Most of these depend upon a squeezing or vibrating action to form and to compact the sand; and with machines of this sort many cores can be made quickly. All cores are hardened by heat; and for this purpose the cores are run into ovens and held there for longer or shorter periods, according to their mass. That is to say, the drying interval may be one night or two nights, and the temperature may range from 350° F. to 450° F. These furnaces, in the foundry in question, are heated by fuel oil—the oil being sprayed with compressed air.

After a casting has been poured and the metal has solidified and cooled to the point where the casting can be removed from the mold, air-operated vibrators or jarring machines may be used to shake the casting free from the enveloping sand. The hardest work,

Some of the bays on the main floor of the foundry showing various activities.



1—Breaking out core with an air-driven pick and cutting fins from a large casting with an I-R chipper.
2—Ramming the mold for a flywheel with a sand rammer.
3—The air-driven hoist has proved especially efficient and satisfactory in the foundry.
4—Spraying blacking on a drag with compressed air.
5—Pneumatic chippers are an indispensable part of the equipment of the finishing department of a foundry.

Ramming the drag of a machine foundation with air-driven sand rammers.

however, that follows next consists in breaking out the core and in cutting off or chipping off the fins that often form on castings where the surfaces of the cope and the drag meet—the molten metal penetrating into every crevice formed by unequal contact of these surfaces. Again, compressed air comes to the rescue to operate chipping hammers and coal picks—the chipping hammers serving to cut off excess metal while the coal picks make comparatively light work of breaking up the baked and hardened masses of the cores. Such inequalities of surface as may remain after the chipping hammers have done their work can be completely removed by air-driven grinders.

In some cases and on some types of castings, the surfaces may be brought to a desired stage of finish by means of sand blasting—compressed air being the driving or propelling medium that projects the erosive grains of sand against the metal to be cleaned.

What has been accomplished in this up-to-date foundry through the wide utilization of compressed air and air-operated tools or machines is an example of what any similar foundry can do when equipped in a like manner. The extensive use of air not only contributes to quantity output and quality production but it helps substantially towards economy in obtaining these results. Finally, the wide employment of compressed air makes for contentment, because it lightens the labors of the workers and gives them the means of turning out rapidly castings in which they can take pride.

The new 145,000-h.p. electric generator, now in course of construction for the Hudson Avenue plant of the Brooklyn Edison Company, could furnish the current necessary for the lighting of 1,000,000 homes. The unit will have a total weight of 1,115 tons; and in order to transport certain of the larger pieces it will be necessary to construct special cars.

SPEEDY WORK IN LINING VEHICULAR TUNNEL

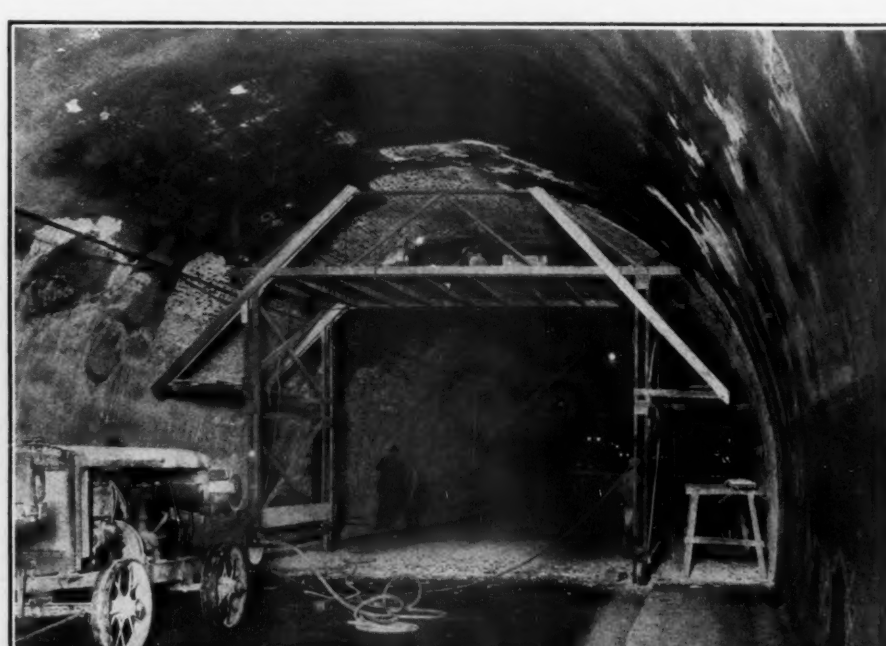
THE waterproofing and the relining of the Third Street Tunnel, a much-used traffic artery in Los Angeles, Calif., was completed not so long ago twenty days ahead of schedule, representing a saving in time of 22 per cent. on a project that was to be finished in 90 days, according to contract requirements. This achievement was mostly due to the enterprise of the contractor and to the extensive use made by him of compressed air.

While compressed air was not employed in placing the concrete, as no forms were used, still a portable compressor, riveting hammers, and "Jackhamers" were on the job 60 days out of the 70 in preparing and generally cleaning the walls of the tunnel, which has a length of 1,042 feet. The contractor, the Permanent Waterproofing Company of Kansas City, Mo., was at first inclined to turn this part of the work over to someone else. But as the estimates submitted were high, he decided to buy the needful pneumatic equipment and to do it himself. According to an officer of the company: "Our cost records show that we have saved money over and above the purchase of this equipment by doing this work ourselves."

As the tunnel had to be open to traffic throughout the hours of the day, it was necessary to carry on all operations during the night. And so as not to interfere with vehicular movement, special scaffolding had to be constructed. This was mounted on wheels, and could be shifted easily by two men as the cleaning and concreting progressed.

About 300 holes were drilled in the walls of the tunnel in order to drain any water that might have accumulated immediately behind the walls of the arches. This drilling was done by "Jackhamers." Riveting hammers, fitted with chipping points, were used to clean the walls—that is, to remove plaster that had become badly disintegrated through moisture. Once the work was well organized, an average of about 30 lineal feet of tunnel could thus be made ready for waterproofing and concreting in a 10-hour shift.

As previously mentioned, no forms were employed in placing the concrete. This was because the differences in the wall surfaces were such that the thickness of the lining was only ½ inch in some places while in others it varied from 8 to 14 inches. Instead, the walls were plastered with scratch coats and then with finishing coats. Straight Portland cement was utilized; and 2 per cent. of "Ironite" waterproofing was added to the mix at the time of its making. By this method, about 25 lineal feet of concreting was done in a day.



The Third Street Tunnel in Los Angeles was lined with waterproofing concrete after the masonry surface had been prepared and cleaned with air-driven tools.

Limestone Quarry Becomes a Mine

By GLEN J. CHRISTNER

THE capability of the modern air-driven rock drill to perform its allotted work is aptly illustrated at the limestone mine of the Independent Gravel Company near Carthage, Mo. There a single drill—of the type recommended by a qualified drilling authority—is putting in the required holes for the breaking out of more than 100 tons of rock daily. The experience of this concern also serves to show that there are times when it is preferable to get out limestone by mining rather than by quarrying.

In 1916, the Independent Gravel Company entered upon the business of producing crushed limestone for various commercial uses. The source of supply is a stratum which yields the well-known Carthage marble and building stone. It is a hard, tough lime rock of high purity, and exists near Carthage in almost horizontal beds lying close to the surface of the ground.

Initially, the work of getting out the stone was done by quarrying; and a quarry face, ranging in height from 30 to 40 feet, was developed on the former site of a dimension-stone quarry. By means of a piston drill, numerous vertical holes were drilled from the top of the face; and at intervals of from two to three months these holes were loaded and shot. Such a blast sufficed to break down enough material to supply the demands of the crushing plant for several months. By this procedure, however, the broken rock was of all sizes and contained many boulders which had to be drilled by block-holing before they could be handled by the methods in use. This added to the expense. Stripping the earth overlying the lime rock was a requisite preliminary to drilling and blasting. This not only was costly but also resulted—despite the exercise of care—in the admixture of more or less dirt with the limestone loaded into the cars going to the crushers.

This method of working the deposit continued until November, 1925, when certain changes were made along lines that had been suggested by a study of the situation. In short, underground mining was substituted for open-pit quarrying. The management found this of twofold advantage: First, it obviated the need of removing the overburden, thereby making it possible to obtain a purer lime rock which could be marketed at a higher price; and, second, it did away with delays and difficulties experienced as a result of seasonal climatic variations. In fact, the change gave rise to much improved working conditions—creating, as it did, an underground chamber which was relatively cool in summer, warm in winter, and dry the year round. Naturally, the efficiency of the labor force increased proportionately.

Another change of importance was the replacement of the old-style piston drill by the latest model hammer drill. The drill selected as best suited for the purpose was an X-70 "Leyner-Ingersoll" drifter. Tests have demonstrated that by the use of this powerful machine the drilling time could be reduced 75 per cent.

Top—Working face, muck pile, and three of the five loading tracks.
Left—View of the working face, which gives a general idea of the mining methods employed.
Right—This Ingersoll-Rand X-70 drill, mounted on a 17-foot column, puts in a sufficient number of holes to break down 100 tons of rock a day.

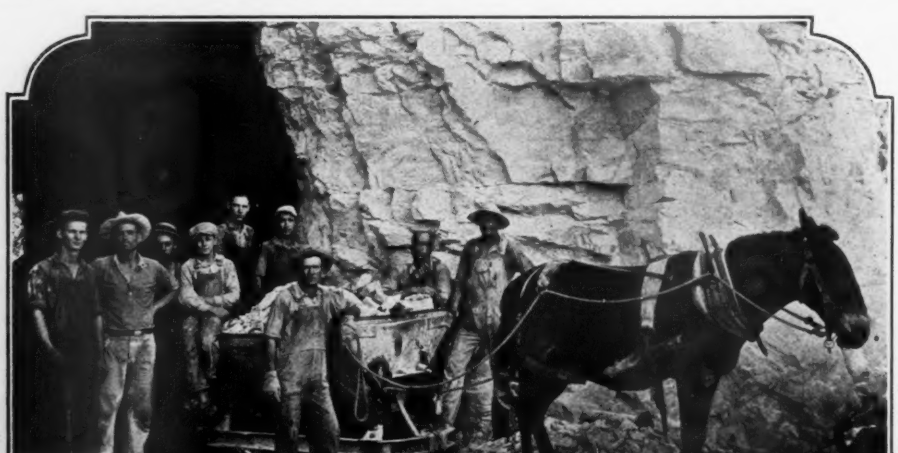
Entries to the underground workings, showing part of the old quarry face at the left.

To turn the workings into a mine, a number of tunnels were driven into the face of the old quarry—a sufficient number of openings being made to provide for light, ventilation, and haulageways. Free circulation of the air was secured by cutting a chimney to the surface at a far point opposite the entrances. Air currents are thus induced that quickly clear the workings of powder smoke or of foul air.

The height of the working face is from 17 to 18 feet. Most of the holes are put in by the drill runner from a ladder—the X-70 drill used by him being mounted on a long column wedged in between the roof and the floor. An average round consists of 4 holes, 16 feet deep. These are loaded with 40 per cent. gelatine-base dynamite. Five loading tracks are maintained—the broken rock being shoveled into small cars. Owing to the short haul to the crusher, the cars are handled by one mule and a driver. The single drill has been sufficient to break down enough rock to supply all the loading stations. It also makes it possible, by properly spacing the holes, to size all rock shot down so that it can be handled without resorting to block-holing.

Since making the changes outlined, the mine has produced at a rate of approximately 31,500 tons of limestone a year, or slightly more than 100 tons a day. Replacements on the drill have consisted of only a few pawl springs costing ten cents each. In brief, the upkeep cost has been kept down and a maximum of drilling efficiency has been attained by proper general care of the machine, including lubrication at regular intervals.

The Independent Gravel Company sizes the stone thus mined into 12 different products. The largest, ranging from 8 inches down to 1 inch, is used in concrete work and in roadbuilding. About 30 per cent. of the output goes into this aggregate. The next commercial size, known to the trade as "chicken grits," is utilized extensively by poultry growers. Other products include "Agstone," an excellent fertilizer which is widely employed in the Middle West; and "Whiting," a finely ground material used in many chemical preparations, such as asphalt fillers, etc. The plant ships to all parts of the central western states and as far north as Chicago and Detroit.



Working crew of the limestone mine of the Independent Gravel Company.

KILOCYCLE—A NEW WORD IN RADIO BROADCASTING

BY order of the Federal Radio Commission, the use of the word meter in broadcasting is to be discontinued in favor of the more suitable word "kilocycle." The change was recommended for the sake of simplicity, as it will be much easier for the listener to log the stations on his dial in kilocycles than in meters.

As defined by the United States Bureau of Standards: "Kilo means thousand, and cycle means one complete alternation." In short, "The number of kilocycles is the number of thousands of times that the rapidly alternating current in the antenna or the set repeats its flow in either direction in one second."

Henceforth, manufacturers will mark the dials in kilocycles; but, in the meantime, to help the users of the old sets to convert meters into kilocycles, the Bureau of Standards has prepared a *Kilocycle-Meter Conversion Table* that may be obtained for five cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Fourteen of Italy's principal seaports—Ancona, Bari, Brindisi, Catania, Cagliari, Fiume, Genoa, Leghorn, Messina, Naples, Palermo, Savona, Trieste, and Venice—have been declared freeports by a recent decree to become effective January 1, 1928.

Lake Champlain Will Soon Be Bridged At Historic Point

Proposed New Link Will Prove a Boon To Travelers Bound Through This Beautiful Region

By P. KNICKERBOCKER

NEW YORK and Vermont are soon to have a closer bond than heretofore: Lake Champlain is to be bridged for the purpose of promoting intercourse between these neighboring states which are separated by this waterway of varying width that lies between them for a distance of substantially 130 miles.

In the early days, Lake Champlain and the Lake Champlain Valley constituted the easiest line of communication between Canada and the American Colonies; and such continued to be the case after those colonies became part of the United States. Indeed, when France and England strove for dominance and sought to possess this land of promise, each of the rival and contending nations successively established trading stations on Lake Champlain and called into being fortified positions to strengthen those outposts of commerce.

As may be recalled, it was by way of Lake Champlain that British forces under Burgoyne, in 1777, endeavored to drive a separating wedge southward between New England and New York. Similarly, during the War of 1812, a like effort was made by way of Lake Champlain; and there, near Plattsburg, on September 11, 1814, Macdonough won his memorable victory over a greatly superior hostile land and naval force.

Conversely, just as Lake Champlain and the Lake Champlain Valley have served in the past to promote traffic north and south, so that waterway has impeded traffic east and west between the continually growing populous sections of the states of New York and Vermont. This situation has become intensified since automotive vehicles have made possible still speedier movement over the country's highways.

True, conditions have been measurably relieved by no fewer than 17 ferry lines maintained at certain crossings during the open months. But these ferries have not been fully equal to the demand; and much inconvenience has been forced upon the motoring public during the rush hours of the summertime when many thousands of cars pass through this beautiful and historic section of the United States.

Finally, after much public agitation and due consideration on the parts of the states immediately concerned, New York and Vermont have brought the matter to a climax through the agency of a Joint Legislative Commission which has approved the building of a bridge across Lake Champlain between Chimney Point, in Vermont, and Fort Frederick, in New York. This decision was reached after thorough study had been given several proposed sites for a bridge; and the choice was influenced by an analysis of the trend of traffic and certain existing physical conditions.

Apart from its own attractions, the Lake Champlain Valley lies between the vacation playgrounds of the Adirondacks on the west and the Green Mountains on the east; and improved highways, which will soon be finished, will offer motorists shorter and better routes to and from Canada. A bridge ample enough to meet the needs of traffic and to

**Top, left—East Barracks of Fort Crown Point. Right—Some of the masonry remnants of Fort St. Frederic.
Bottom, left—Part of the moat of Fort Crown Point. Right—Looking north on Lake Champlain from Fort Crown Point.**

Ferry landing adjacent to what is now known as Fort Frederick.

Memorial Lighthouse just south of Fort Frederick.

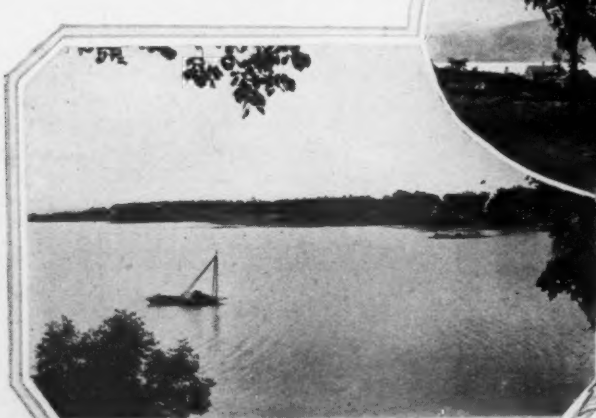
Where the French soldiers baked their bread and cooked their food when Fort St. Frederic was in its prime.

render interstate communication possible at all hours and in all seasons had, therefore, become an indispensable public improvement. With this recognized, the only remaining phase of the problem was to determine where best the bridge could be built for the common good.

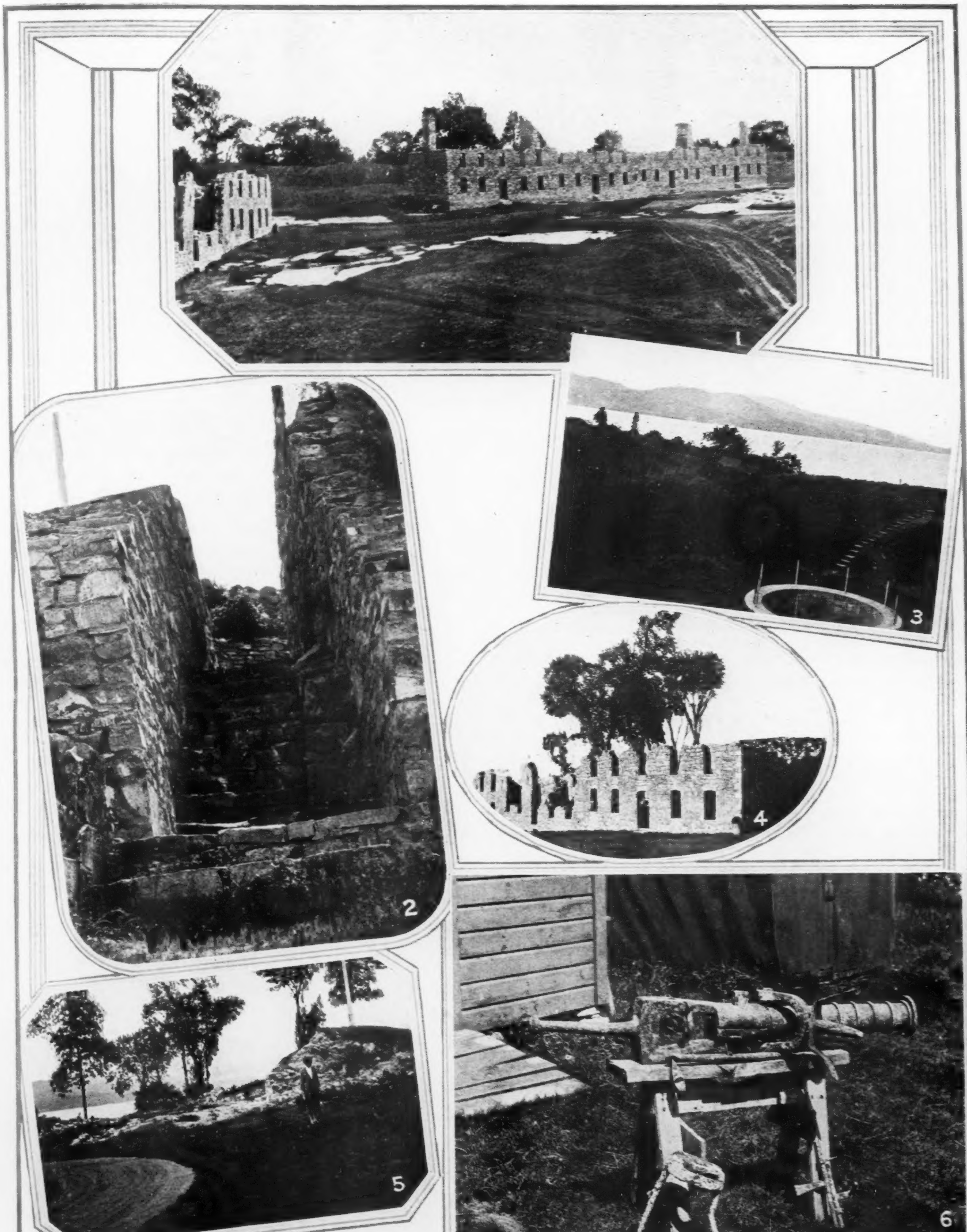
As most of us know, Samuel de Champlain, the French explorer, discovered the lake in 1609. From its southern end northward, for a distance of 40 miles, Lake Champlain ranges in width from one-fourth of a mile to a mile, and is more or less like a river in its characteristics. Then, somewhat abruptly, the lake widens, and its shores do not again come close enough to each other to make a bridge practicable until the passage is reached that lies between Chimney Point and old Fort Frederick. Thence northward the lake has a far greater spread; and adjacent to the mouth of the Ausable River the shores are separated by a distance of 11 miles.

Lake Champlain has an area of approximately 500 square miles; and it is surpassed in size, in this country, only by the Great Lakes and by Great Salt Lake. The basin in which Lake Champlain lies is the remnant of a glacial-scarred valley in which an ancient sea once ebbed and flowed when the Adirondack Mountains were in their infancy and the Green Mountains had not risen from the ocean bed. When the ice cap retreated and the glacial mass scored its way northward, the net result of that ponderous movement was to carve the opposing rock so that the shore lines dip sharply into the depths of the remaining water. Today, the central part of the lake varies in depth from 200 to 300 feet. Therefore, in choosing a point for a bridge it has been necessary to select a site where the shores are conveniently near to each other and where supporting rock for piers could be found at workable depths along the line of the projected structure—thus simplifying the engineering problem; obviating long and expensive spans; and, incidentally, insuring a bridge of ample capacity at a relatively moderate outlay. The crossing between Fort Frederick and Chimney Point meets these requirements in every essential particular. That is to say, the distance from shore to shore is 1,630 feet; and a bridge 2,800 feet long—including approaches—could be built for about $1,000,000.

The approved general plan calls for a bridge having a central span 300 feet long with a clearance of 90 feet above high water. The structure will have the appearance of a flat arch made up in the main of a series of short spans supported on concrete piers resting on solid rock lying below the normal lake bottom. On the New York side the approach will lie within the State Reservation occupying the northern end of Crown Point Peninsula and, of course, adjacent to Fort Frederick. Immediately south of the bridge site, also on the New York side, is the Memorial Lighthouse erected on a nearby headland to commemorate the 300th anniversary of the discovery of Lake Champlain. These historic monuments have annually attracted thousands of visitors; and for some years a ferry line has been maintained by which vehicles could make their way to and fro across the lake.



Left—Drill boat making exploratory borings along the line between Fort Frederick and Chimney Point.
Oval—Looking westward from Crown Point toward Fort Henry.
Right—Chimney Point, in the distance, seen from the rampart of old Fort Crown Point.



1—All that now remains of the stone barracks built within Fort Crown Point.
2—Stairway entrance to the tower that once dominated Fort St. Frederic.
3—The well that furnished water to the troops quartered within Fort Crown Point.
4—Ruins of the East Barracks of Fort Crown Point.
5—On the site of Fort St. Frederic.
6—An ancient breech-loading cannon discovered when making excavations near Fort St. Frederic.

This ferry, however, has been unequal to the rush-period demand.

Test borings made along several lines across the lake where bridging seemed practicable revealed that the lake bottom was covered with a deep layer of soft clay. There was apparently no firm material of any sort intervening before solid rock was reached, except in the case of the line between Fort Frederick and Chimney Point where rock was found at a maximum depth that would permit the emplacement of the necessary bridge piers. Elsewhere, the rock formation at the water's edge dips precipitously and is at a prohibitive depth towards midstream.

There were the best of reasons for believing that the clay overlying the bedrock would not prove sufficiently stable for foundations even when stiffened with long piles closely spaced. Accordingly, the choice narrowed to three sites, viz: Fort Frederick to Chimney Point; Fort Ticonderoga to Mt. Independence, and Wright's to Chipman's Point. The Joint Legislative Commission, of which Senator Mortimer Y. Ferris is chairman, has recommended the Fort Frederick-Chimney Point location; and the bridge will be built there for the reasons already mentioned. The structure will have a 24-foot roadway, and will be of sufficient strength to permit its use by 20-ton motor trucks. The bridge will be constructed, owned, and maintained jointly by New York and Vermont; and work upon it will be taken in hand shortly.

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A collapsible rubber raft of this type, quickly inflated with compressed air from small steel flasks, saved Byrd and his companions when his aircraft was wrecked at Ver-sur-Mer, France.

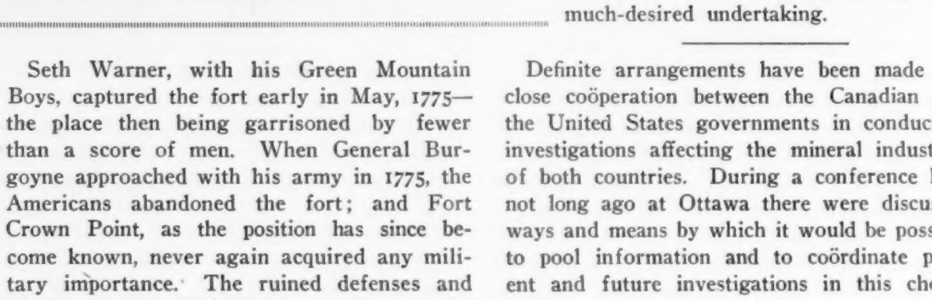
Fort Crown Point was originally a British trading station; but along about 1731, when the nations of Europe were at peace, the French reared there the defenses which they named Fort St. Frederic. The walls were of limestone, and enclosed stone barracks, a church, and a bombproof tower. The armament was made up of 62 cannon. Near the fort, so it is recorded, there was a town of 1,500 inhabitants provided with stores and paved streets. The French intended to make this fortified community the capital of a new province that was to reach from the Connecticut River to Lake Ontario.

Despite the fact that several expeditions were sent against Fort St. Frederic during 1755-56, still the French held on until the garrison retired southward to Fort Ticonderoga, at the intersection of Lake Champlain and Lake George. When the French abandoned Fort St. Frederic, General Amherst took possession; and between 1759-60 were begun the fortifications that were never completed and that were said to have cost many millions of dollars. The surviving ruins bear mute testimony to the work and to the money expended under General Amherst's supervision. The ramparts are 25 feet thick, nearly the same in height, and faced with solid masonry. These defensive walls have a circuit of 853 yards. In 1773 the barracks took fire, and the exploding magazine destroyed parts of the fortification. For some time the position was known officially as Fort Amherst.

Seth Warner, with his Green Mountain Boys, captured the fort early in May, 1775—the place then being garrisoned by fewer than a score of men. When General Burgoyne approached with his army in 1775, the Americans abandoned the fort; and Fort Crown Point, as the position has since become known, never again acquired any military importance. The ruined defenses and the land upon which they stand became the property of F. S. and W. C. Witherbee of Port Henry, N. Y., and in March of 1910 those patriotic men deeded the property to the State of New York upon condition that it be: "Forever dedicated to the purpose of a public park or reservation, the people of the State of New York agreeing to protect the fort ruins on said land from spoliation and further disintegration to the end that they may be preserved for all time, so far as may be." This has been done in the case of the buildings by forcing grout into the cracks of the stonework where the original mortar had become decomposed.

With the construction of the bridge and the completion or improvement of connecting highways, Crown Point, with its historic associations, will be within easy reach of many thousands of persons speeding north and south along the shores of Lake Champlain or bound east and west across New York and Vermont. Undoubtedly, in the building of some of the piers, pneumatic caissons will be used to place the foundations firmly upon the bedrock lying below the water bed. Compressed air will, in all likelihood, have other services to perform in connection with this interesting and much-desired undertaking.

Definite arrangements have been made for close coöperation between the Canadian and the United States governments in conducting investigations affecting the mineral industries of both countries. During a conference held not long ago at Ottawa there were discussed ways and means by which it would be possible to pool information and to coördinate present and future investigations in this chosen field.



Building houses of rammed earth is a common practice in Peru. These photographs show the old and the new methods of ramming the earth. The I-R pneumatic "Jackhamer" at the right is equipped with a special tamping pad.

Promising Potash Beds Found In Our Southwest

By GUY E. MITCHELL

THE European potash monopoly, one of the big monopolies of the world that has had American farmers by the throat for a generation, is broken. This is the good news to be gathered from a statement made by the United States Geological Survey, which has been searching for potash the country over for the past 15 years.

This monopoly was thought broken when France, as a result of the World War, secured German territory in the recovery of Alsace-Lorraine, where are located part of the great German potash deposits. This was encouraging news for American farmers, to whom potash is indispensable. But, as the situation has turned out, the American farmer is no better off than he was before, and he has to pay more or less dearly for all the potash he obtains from abroad.

Cross section of a 5-inch drill core containing fossilized sea shells. This was one of a great number of cores obtained while drilling for possible potash deposits.

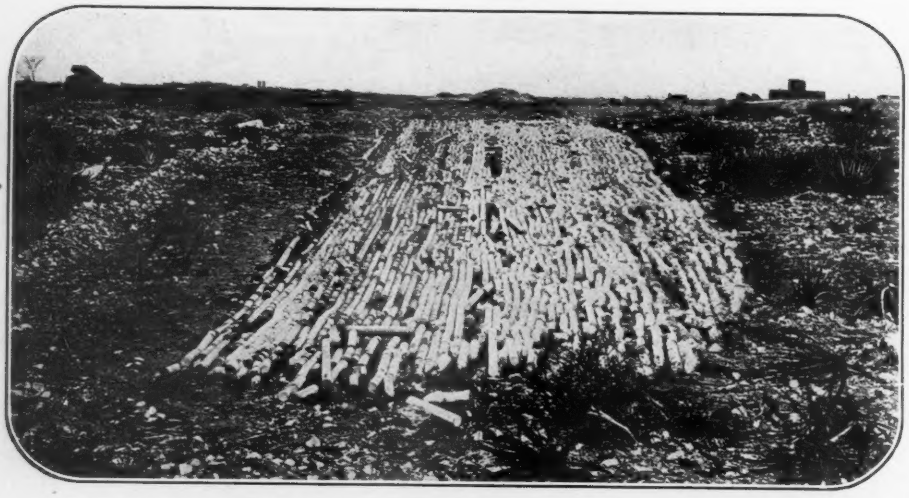
Foreign potash monopolies will, of course, suffer if the reported deposits in Texas and in New Mexico eventually prove to be as extensive as our geologists are at present inclined to think. Unquestionably, a domestic source of potash, large enough to meet our needs, would be a boon to American agriculture. Conversely, dependence upon alien sources of supply will continue to cause irritation among our farmers, as they are the first to feel the effects of any increase in the price of this fertilizer. Offhand, the man in the street cannot be expected to become immediately interested in this subject; but, sooner or later, he has to bear the burden because he cannot get along without food. Any added cost in making the farm pay must come out of the pocketbook of the ultimate consumer.

Aside from the need of ample supplies of nitrogen and phosphorus, nothing is more essential to productive farmlands than potash. All three are fertilizers, and all three are absolutely necessary not only to the farmer but to every man, woman, and child in the land. If our sources of nitrogen, of phosphorus, and of potash should become exhausted, then all plant growth would cease—we should be deprived of life as soon as our little store of foodstuffs had been consumed. No tree could grow, no vegetable, no wheat or other grain: all vegetation would disappear from the earth, and there would be no bread or meat for us to eat. Hence, our potash supply is something more than the farmer's problem; and a scarcity of that essential fertilizer as contrasted with a plentiful and cheap supply means all the difference between a high and a low cost of living.

In the billions of tons of phosphate rock recently discovered by the Geological Survey in Utah, Wyoming, Idaho, and Montana, we have unlimited sources of phosphorus. And the enormous water-power resources of the Colorado and other great streams—to say nothing of Muscle Shoals—assure us an equally unlimited supply of cheap nitrogen. What we needed, and needed badly, was nitrogen—the key to low-priced farm produce. While it is true that we are now getting some potash from domestic sources, still this is inadequate to meet our demands.

A little study of statistics will reveal that cheaper potash will immediately bring in its train a greater use of potash in this country.

Left—Artichokes grown without fertilizing the soil.
Right—Artichokes produced by enriching the soil with potash, phosphate, and nitrogen.



Rock-drill cores that enabled the geologist to determine and to classify the strata penetrated in the search for potash deposits in Texas.

While drilling for oil, potash deposits were penetrated that may prove of enormous value.

Chemical laboratory of the United States Geological Survey in which thousands of analyses have been made in the course of the last 15 years in a quest for a domestic source of potash.

During the first 10 years of the present century, American potash imports rose from about 350,000 tons to 900,000 tons; and, except for the higher prices forced upon us by the potash monopoly and the stoppage of shipments during the war, the consumption would probably have continued to increase because potash had proved itself a wonder worker in stimulating plant growth.

This situation induced the United States Government to undertake a country-wide search for potash deposits; and it is gratifying to learn that the labors of the exploration parties have been rewarded with noteworthy success. By watching the logs of many oil wells that were being drilled in what are known as the Saline Redbeds, geologists—following the lead of Dr. J. A. Udden, Director of the Texas Bureau of Economic Geology—discovered that a great area in western Texas and southeastern New Mexico is underlain with beds of potash salts. Likewise, in analyzing a core from a diamond drill, employed in drilling an oil well, the Geological Survey learned that the drill had penetrated 36 feet of high-grade potash salts lying at different points between the 90c- and the 1,900-foot levels. This core came from the McNutt Well drilled by the American Potash Company on public land in New Mexico.

A number of these beds are considered commercially workable; and a single bed, at a depth of only 990 feet, contains 5 feet 3 inches of potash salts analyzing 14.6 per cent. of pure potash. This bed, it is believed, extends for miles in all directions from the well; but even if it lay within a radius of only a mile from the drill hole, still it would contain, so it has been estimated, more than 40,000,000 tons of potash. Representatives of the American Potash Company have announced that the company, in coöperation with the Geological Survey, is going ahead with other wells and would begin the mining of potash as soon as sufficient ground is proven. At the same time, the Government is pushing its own potash program in that region under the Sheppard law, which provides a sum of $100,000 a year for the next 5 years for exploratory drilling.

In commenting on the probable magnitude of our potash deposits, George R. Mansfield, in charge of the United States Geological Survey's potash investigations, has queried: "It would be rather strange, would it not, if this first core-drilled well in the great Saline Redbeds area—an area as large as that of the entire State of Virginia—should have penetrated the richest beds?" And George Steiger, Chief Chemist of the Geological Survey, has made the unqualified statement that "It is not unreasonable to suppose that the Texas-New Mexico deposits contain enough potash to supply the United States for thousands of years." Should this prove true, and should our deposits turn out to be as extensive as those under German control, then—according to George Otis Smith, Director of the United States Geological Survey—they will have a value far in excess of that of all the gold mines in this country.

Heavy-Oil Engines and Their Uses

Sketch of Development of Oil Engines and Their Present Use and Importance in Industry and Transportation

By H. A. PRATT*

IT is almost a trite remark to say that power has freed man from industrial slavery, but, nevertheless, this is so. The late Doctor Steinmetz said that in time we should find a 2-hour working day sufficient for the average industrial worker. It is a fact that the comparative wealth and leisure enjoyed by many millions in this country are largely due to our application of power. One man with a mechanical horsepower at his command has multiplied his productive capacity by ten. In effect, this is equivalent to having five slaves working for him. There is more power used in the United States than in any other country. The total prime-mover horsepower in the United States today is approximately 60,000,000.

In 1900, the prime movers installed in the United States totaled about 16,000,000 h.p. At that time the wealth of the country was about $88,000,000,000. In 1922, the prime movers installed totaled approximately 52,000,000 h.p., and the wealth of the country had grown to over $320,000,000,000. These figures bring out very clearly the important place the application of power has had in the growth of the wealth of our country.

It is rather strange for us to hark back a few generations and realize that James Watt had just begun to develop his steam engine while we were writing the Declaration of Independence; in fact, it was a year before, in 1775. Prior to that time the only power in the whole world was manpower, windmills or treadmills, and perhaps a few crude applications of waterpower. You might, however, make one exception. There was a man named Newcomer, who developed a very crude steam engine for pumping about 60 years before Watt. The principle of it was as follows: Low-pressure steam was run under a big piston, and at the end of the stroke a quantity of water was introduced, condensing the steam quickly. The cylinder being open at one end, the piston was then pushed down by the pressure of the atmosphere.

Manager, Oil Engine Department, Ingersoll-Rand Company.

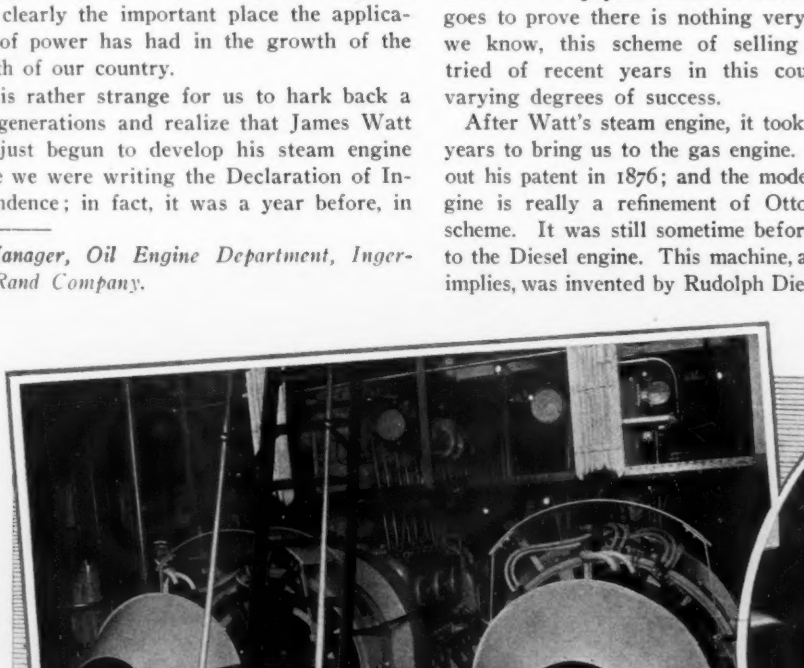
Newcomer's engine was a step in the right direction. Many installations were made in mines. Then, after Watt had introduced the cut-off and other principles of the steam engine, the old engines were discarded very quickly. Watt organized a company and began to sell his engine to the mines already using the cruder type. The story says that he took his payment out of savings, which goes to prove there is nothing very new. As we know, this scheme of selling has been tried of recent years in this country with varying degrees of success.

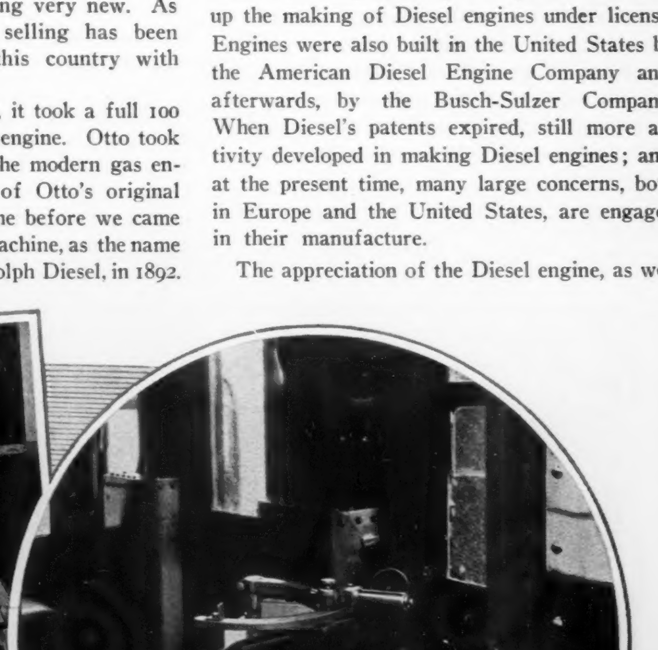
After Watt's steam engine, it took a full 100 years to bring us to the gas engine. Otto took out his patent in 1876; and the modern gas engine is really a refinement of Otto's original scheme. It was still sometime before we came to the Diesel engine. This machine, as the name implies, was invented by Rudolph Diesel, in 1892.

Doctor Diesel died in 1914. It was soon after the World War broke out that he came here from Germany with a lot of plans and schemes. Germany had not accepted his ideas; and he was again refused in this country. Thereupon he sailed for England. He was never heard of afterwards. Whether he was put away by foul means, or whether he was just discouraged and jumped overboard, nobody knows—he simply disappeared. Diesel's, however, was the original scheme; and he is the man to whom great credit must go in developing the oil-engine industry.

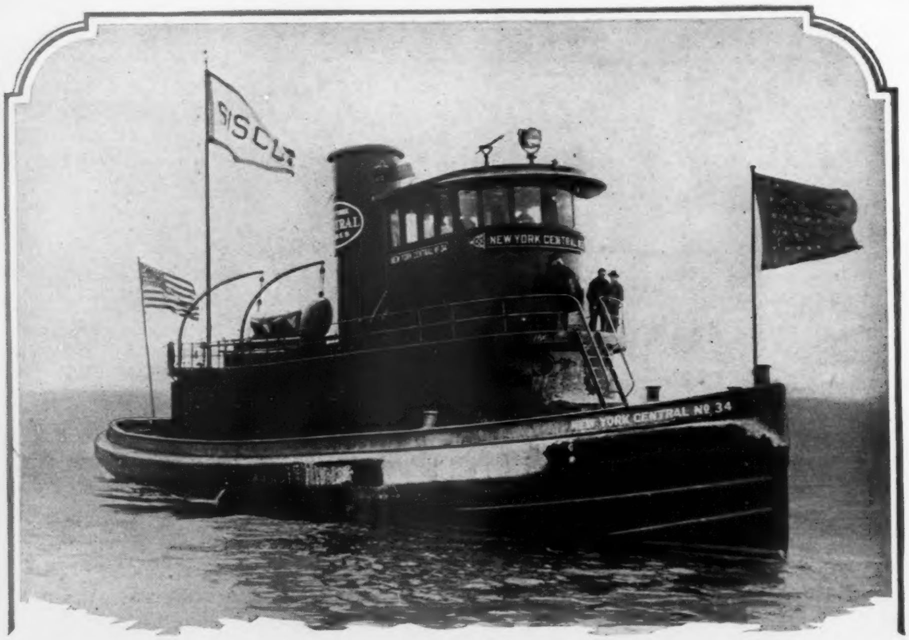
Diesel's patent did away with the necessity of using a hot bulb, plate, or any other application of external heat in starting the engine. Under his plan, ignition took place by the heat of compression. He had various ideas; and it was not until 1900 that he announced what we now call the Diesel cycle—that is, compression to about 500 pounds, admission of the fuel oil by compressed-air injection, and combustion at contant pressure followed by adiabatic expansion. After 1900, many European firms took up the making of Diesel engines under license. Engines were also built in the United States by the American Diesel Engine Company and, afterwards, by the Busch-Sulzer Company. When Diesel's patents expired, still more activity developed in making Diesel engines; and, at the present time, many large concerns, both in Europe and the United States, are engaged in their manufacture.

The appreciation of the Diesel engine, as well





Left—Exciters, generators, and 400-h.p. I-R oil engines which furnish the power for propelling one of the newest tugboats in New York Harbor.
Right—The cab of an oil-electric locomotive, showing the absence of complicated control devices.



Tugboat "No. 34" of the New York Central Lines in New York Harbor. Two 400-h.p. oil engines drive 270-kw. generators which, in turn, supply power for the 650-h.p. motor that propels the vessel. The craft was placed in service early this year.

as its exploitation, was slow in this country. It is only within the last few years that engineers and users have begun to realize its importance—in fact, about 90 per cent. of the Diesel engines in this country have been installed since 1918. This figure is given by Mr. L. H. Morrison in an article in *Power,* issue of January 11, 1927. He uses the term Diesel to embrace only those engines that are cold starting, or, as some use the term, full-Diesel engines. Oil engines of the cold-starting type, full-Diesel engines, are divided into two general classes: air-injection Diesel engines as covered by Doctor Diesel's patent, and solid-injection Diesel engines as worked out by various other engineers. Among the best known of the latter group is the late William T. Price of this country.

The term full-Diesel came into use because the first oil engines were semi-Diesel engines—that is, they were not cold starting. It was necessary to apply heat to a bulb or bolt in the head and get up sufficient heat to ignite the charge of fuel oil, otherwise the engine would not run. While many of these semi-Diesel engines were very successful, many were not; and the development of the oil-engine business has been retarded by the fact that people often think of oil engines in connection with some experience of a few years ago with so-called semi-Diesels.

The "J. W. Van Dyke," an oil-electric-driven ship, passing through the Panama Canal.

This should not be done. Last year there were over 300,000 h.p. in full-Diesel engines sold by the oil-engine manufacturers of the United States. The output of semi-Diesel engines is negligible today. Of the so-called full-Diesel engines sold in the United States in 1926 about 60 per cent. were solid injection and 40 per cent. air injection. The solid-injection engine eliminates the necessity of complicating an oil-engine installation by the addition of a high-pressure compressor. The solid-injection type is fast coming into prominence—in fact, it is the opinion of many competent engineers that, in engines below 1,200 h.p., this type will be the engine of the future.

Practically all engines of 1,200 h.p. and under are either 4-cycle or 2-cycle, single acting. There is nothing complicated about the operation of the modern oil engine—any operator can be quickly trained to run it. Compressed air at about 200 pounds must be available for starting the engine. The compressed air turns the engine over, allowing compression to build up in the cylinders. The heat of compression ignites the fuel oil which has been pumped into the cylinder, and the engine starts. Well-designed governors give a speed regulation of about 2 per cent. If fuel, lubricating oil, and cooling water are supplied, the engine will run continuously.

Diesel engines installed in this country today are found in all industries. They are not merely in the oil field, although it is true that oil fields have taken a great many for those great pumping lines, where they pipe oil for thousands of miles, with a pumping station every 30 miles or so. These pumps must operate day and night. Today there are hundreds of oil engines operating on these pipe lines for periods of from 3 to 4 months at a time without shutting down. There is a cement plant in Texas where they regularly run for 4 months—120 days—and then shut down for inspection. A 100-h.p. engine in a glass plant in New Jersey ran 8 months and 23 days, and was then shut down for inspection. However, an oil engine on continuous service should be shut down for inspection at least every 4 months.

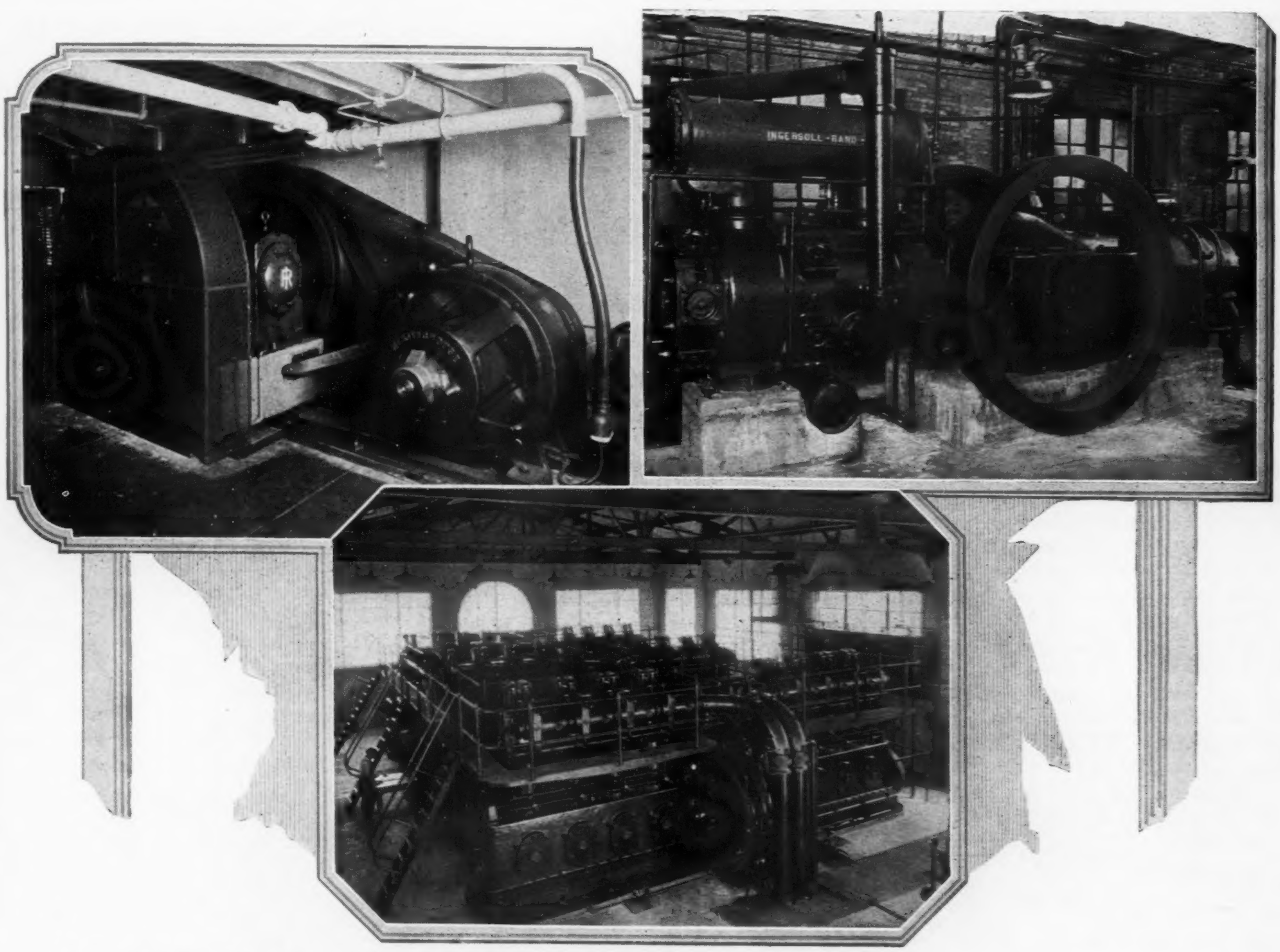
Texas has more full-Diesel oil engines than any other state—137,000 h. p., according to figures in *Power,* issue of January 11. The diversification of these oil-engine installations is truly remarkable. They are in all states and in all industries. Central stations have taken 18 per cent.; pipe-line companies, 20 per cent.; refrigeration plants, 5 per cent.; mines and quarries, 5 per cent.; pumping plants, 5 per cent.; marine, 25 per cent., etc. In fact, wherever economical power is desired, an oil engine is applicable.

The fundamental reason why the oil engine is taking, and will continue to take its place in industry and transportation, is because of its high thermal efficiency—33 per cent. According to a statement in the *Electrical World,* quoting the late General Tripp of the Westinghouse Electric & Manufacturing Company, the thermal efficiency of our largest steam turbines is 16 per cent. The

ordinary thermal efficiency of a 1,000-h.p. steam plant is only 10 per cent. Many steam plants are running around 5 and 6 per cent. When you can take a pound of oil containing 18,500 B.T.U.'s and obtain a horsepower for less than one-half of it, you have a truly remarkable prime mover. A theoretical horsepower is equivalent to 2,545 B.T.U.'s. Therefore, using a figure usual in well-designed oil engines of 0.43 of a pound of oil to a horsepower, it is seen that 1 h.p. can be obtained from a quantity of oil containing 8,000 B.T.U's.

In the case of the oil engine, the steam boiler has been eliminated. The oil is burned in the has also become a very important factor. In transportation the urge to excel has always been a great incentive to bring out new things. Since the earliest times there has always been a pressure on transportation. We can go back to the ancient days with their old galley ships. Then we had the sailing ships, the fast messengers on land, camel routes, etc. In this country the most romantic thing was our old pony express. Finally, we arrived at steam. And the urge to get something better and better all the time has made transportation progressive. The industry that took up the oil engine most seriously and enthusiastically was the marine industry. Of the world's shipping injection Diesel engines driving generators, the current from which drives the motor on the propeller. The entire control is in the pilot house. The captain controls that ship as he would an automobile: he can reverse it himself, he is not obliged to signal the engine-room.

Recently, Diesel-electric equipment was adopted by the Pennsylvania Railroad for their tugs, and now they have a number of them. In New York Harbor, the New York Central just put into commission the largest oil-electric tug in the world. It is 107 feet long, and has two 400-h.p. solid-injection engines driving generators. Here, again, the control is from the



**Left—A 50-h.p. oil engine driving a generator in a Philadelphia industrial plant.
Right—This direct-connected oil-engine air compressor supplies air for sand blasting in a middle-western factory.
Bottom—Three 800-h.p. I-R oil engines which drive generators in a cement plant on the Pacific Coast.**

engine cylinder; all power is delivered from the fuel to the shaft as useful energy except the heat that is lost in the water jackets, which is about 30 per cent., and the heat in the exhaust gases, which is another 30 per cent. The mechanical efficiency is anywhere from 85 per cent. in a solid-injection engine to 75 per cent. in an air-injection engine. These oil engines are manufactured by some 40 concerns in the United States. They are made in many different sizes; and although 1,200 h.p. will cover the majority of sizes, some engines as large as 4,000 h.p. have been built.

In the field of transportation, the oil engine being built in September, 1926, there were 212 ships with reciprocating engines of 329,000 h.p.; 42 ships with turbines of 434,000 h.p.; and 271 ships with oil engines of 781,000 h.p. Thus, more than 50 per cent. of the shipping was being equipped with oil engines. In service in 1914 there were 297 ships equipped with Diesel engines—a gross tonnage of 234,000. In July, 1926, there were 2,343 ships equipped with Diesel engines, and the tonnage was 3,500,000.

In this country, the largest Diesel-electric ship in the world runs out of Philadelphia. It is the *J. W. Van Dyke,* a tanker of 8,000 tons. This ship is equipped with three 840-h.p. solid- pilot house. This control is particularly efficient in tugboat work. Economy is an added feature: in one year the difference in cost between a steam tug and an oil-electric tug is saved. After that, the capital cost is soon written off. These oil-electric tugboats can take on fuel enough at one time for a month's service—something which is a great improvement over the old custom of taking on fuel every three or four days.

Practically all new yachts today are either direct-drive Diesel or Diesel-electric. The *Asturias,* a new 22,000-ton passenger ship, was recently put into commission. She is a twin-

screw ship with a 10,000-h.p., double-acting Diesel engine driving each propeller. From these examples and figures it will be seen that the oil engine is already dominating the marine field.

The next field in transportation is the railroad. Here we find the oil-electric locomotive. Considerable publicity has been given to the subject; and a number of oil-electric locomotives are being developed today. The only ones now running in the United States are those which have been built conjointly by the General Electric Company, the American Locomotive Company, and the Ingersoll-Rand Company. There are a number of these operating in New York City, Chicago, and Philadelphia. A 60-ton oil-electric locomotive, for example, is operated by a 300-h.p., 6-cylinder, solid-injection oil engine, weighing about 55 pounds per horsepower. This, of course, is very light for a Diesel engine. The ordinary commercial Diesel engine weighs from 200 to 300 pounds per horsepower.

The Chicago & North Western Railway is cooperating in Chicago's smoke-elimination movement by substituting oil-electric for steam locomotives in switching service. Three of the type shown in this picture are now in use there.

The oil engine drives a generator, and the current from the generator drives the electric motors on the trucks. The engineer sits in the cab and handles two controls. One is for forward and reverse on the motors. The other control is the throttle that controls the speed of the oil engine. The oil engine runs only in one direction. The operation is simple, and the expense is much lower than that of a steam locomotive mainly because of the thermal efficiency of the oil engine. The initial oil-electric installations worked out very successfully; and there is a great field for them in both switching and main-line work.

This paper has covered in a very brief way the development of the oil engine and its growing use in industrial plants and in transportation on land and sea. In all these branches it is fast making progress, as it is a proven method of reducing power costs.

A horsepower can be produced for less than ½ cent for fuel. Ice, for example, can be produced at a fuel cost for power of 25 cents per ton. One thousand cubic feet of air at 100 pounds pressure can be delivered for 1.2 cents. Installations of great diversity of application are paying for themselves in one, two, and three years.

The oil-electric locomotive operates at a fuel cost of about one-quarter of that of the steam locomotive. If it were applied merely to yard switching work on all our railroads, there could be made a fuel saving of over $55,000,000 annually.

In marine work the Diesel engine cuts the fuel cost to from one-half to one-third the cost of steam.

As a prime mover the oil engine cannot be overlooked by those who desire economy and efficiency.

In closing, attention should be called to the fact that frequently there is talk of a scarcity of oil. For example, there was a real scare last summer due to a misinterpretation of a Government report. Altogether, the statements regarding a scarcity of oil have been well refuted. Apparently, while gasoline and coal are used there will be plenty of fuel oil for these engines which are beginning to take such a prominent part in our industrial life.

MINE VENTILATION

THE problem of proper mine ventilation is one that has been given serious consideration and study in late years and, as a result, much has been done to improve underground working conditions. These conditions, it has been found, may vary so greatly as to demand the use of chilled air, on the one hand, and preheated air, on the other, so as to make it possible for the miners to work in comfort.

For example, in the case of the Village Deep Mine in South Africa, which has penetrated to a depth of 7,000 feet, it was discovered that the atmosphere at that level has a temperature approaching that of the human body—97.5° F. Under such conditions men can no longer do useful work. How was the situation met? By passing the ventilating air over ice before delivering it to the headings, and also by employing sprays of chilled water to cool the warm air reaching the winzes.

By way of contrast, the Gallup American Coal Company, at Gamerco, New Mexico, found it necessary to resort to the use of preheated ventilating air because of the formation, in the wintertime, of ice in the shaft containing the airway. By an arrangement of four banks of steam pipes, the temperature of the air entering the fan can be raised as much as 50 degrees—thus making it possible to regulate the temperature of the air forced into the mine to suit requirements. Besides, by preventing the accumulation of troublesome ice in the shaft, the concrete is protected from the disintegrating action of frost and thaw.

Steel having an elastic limit of from 75,000 to 100,000 pounds per square inch has been produced, so it is claimed, by C. W. Bryan and C. G. E. Larsson, chief engineer and assistant chief engineer, respectively, of the American Bridge Company. With steel of so high an elastic limit it will be permissible to increase the unit working stress from 16,000 pounds to 50,000 pounds per square inch—thus making it possible, so it is said, to use less than one-third as much material as would be required if steel were utilized having the ordinary elastic limit of 30,000 pounds per square inch.

This oil-electric locomotive is in switching service in the yards of the Erie Railroad in New York City.

Harnessing The Gatineau River

By Damming This Waterway at Three Points It Will Be Possible to Develop About 500,000 Horsepower

PART II

By R. C. ROWE

FROM the storage dams we have to travel 90 miles downstream before we strike the first and largest of the three powerhouses that are being installed. This plant is at Paugan Falls, and will have a capacity of over 200,000 h.p. Work at this point is, however, only in the preliminary stages. The other two power plants are within 8 miles of the City of Ottawa at Chelsea Falls and at Farmers Rapids, respectively. Work on both these undertakings is well advanced, and it is expected that power will be available this year. The construction of the powerhouses and the paper works, at Gatineau, is in the hands of the Fraser-Brace Engineering Company, Ltd., and under the active supervision of Maj. James H. Brace.

Chelsea Falls is a naturally ideal power site—the Gatineau at that point being divided into two channels. On one of these channels is the powerhouse, and on the other the sluices and the spillway. The elevation at the lip of the spillway is 315 feet above sea level, and the tailrace elevation is 222 feet—giving an effective operating head of 93 feet, which is as high as that at Muscle Shoals.

A crest level of 315 feet at the Chelsea Dam will create a lake, about 12 miles long and averaging 1½ miles wide, that will flood much land. As Chelsea and its environs was a well-known summer resort, a large number of cottages had to be bought and torn down. It was also necessary to shift to higher ground 5 miles of Canadian Pacific Railway trackage, and to lay out and to build about the same length of roadway in place of the present provincial highway that will be underwater when the sluice gates are closed.

The dam is about 1,600 feet long, and is fitted with 5 sluice gates. The power plant, which constitutes part of the west side of the dam, is 300 feet long, 140 feet wide, and 70 feet high. It is a steel-and-brick building, with a concrete substructure. It houses five 34,000-h.p. units, giving a total of 170,000 h.p. The turbines are of the single-runner, vertical-shaft, Francis type and were supplied by the Dominion Engineering Company, while the generators and the electrical equipment were furnished by the Canadian Westinghouse Company.

Despite the fact that the power plant is smaller, still the development at Farmers Rapids is a bigger job and involves features that do not enter into the work at Chelsea. The dam, which is roughly V shaped, is over 4,500 feet long. About 2,100 feet of this is rock fill—the remainder of the structure being concrete. The powerhouse is at the apex of the V; and the east and the west dams form the flanking arms. The earth fills are at the upstream faces of these flanking arms.

The crest level is 222 feet—corresponding with the tailwater elevation at Chelsea. The tailwater elevation at Farmers Rapids is 153 feet, giving an operating head of 69 feet. The spillway is 1,416 feet in length and forms part of the west dam. This entire structure has been bridged and equipped with standard-gage railway tracks, which run to the powerhouse.

The powerhouse, similar in design to that at Chelsea, is 320 feet long and 138 feet wide. It also houses five units; but, in this case, each unit is of 24,000 h.p. The Dominion Engineering Company supplied the turbines, and the Canadian General Electric Company the electrical equipment. The big generators at Chelsea and at Farmers Rapids will furnish current of 6,600 volts, and the direct-connected exciters current of 250 volts. For transmission to the paper mills at Gatineau and for local requirements, generally, the current will be stepped up in the transformer rooms to 110,000 volts.

It is probable that the Paugan development will supply most of the 260,000 h.p. called for under the contract with the Hydro-Electric Commission, though all three plants will be hooked up to take care of inequalities and emergencies. It has not yet been decided at what voltage the current will be sent over this line, but the assumption is that it will be at

The rock drill has had plenty to do in clearing the sites for the powerhouses and dams at Chelsea and Farmers Rapids.

Spillway at Farmers Rapids as seen from different angles. This V-shaped dam is 4,500 feet long and is 222 feet high at the crest level.

220,000 volts. The Paugan transformer station will distribute directly to the Hydro's transmission lines; and if at any time current is needed from Chelsea or from Farmers Rapids it will be stepped up from 110,000 volts to the voltage required.

Heavy rock excavation has been a feature on both these jobs. At Chelsea, the rock removed for the powerhouse foundation and the tailrace channel totaled 178,000 cubic yards. At Farmers Rapids, the powerhouse called for the excavating of 44,000 cubic yards of rock, and the tailrace channel 110,000 cubic yards of rock and 50,000 cubic yards of earth. Naturally, rock removal of such magnitude required up-to-date machinery; and it is of interest to note that Ingersoll-Rand equipment was used throughout. At Chelsea, 23 DDR-13 "Jackhamers" were used for drilling, while the rock at Farmers Rapids was disposed of rapidly by the aid of 18 drills of the same type. In each case, sharp steels were provided by "Leyner" sharpeners. The rock is the usual Laurentian complex characteristic of the Gatineau district. Granite appears to predominate, though pyroxene can be noted. It is all igneous in origin and very hard; but the "Jackhamers" handled it very effectually.

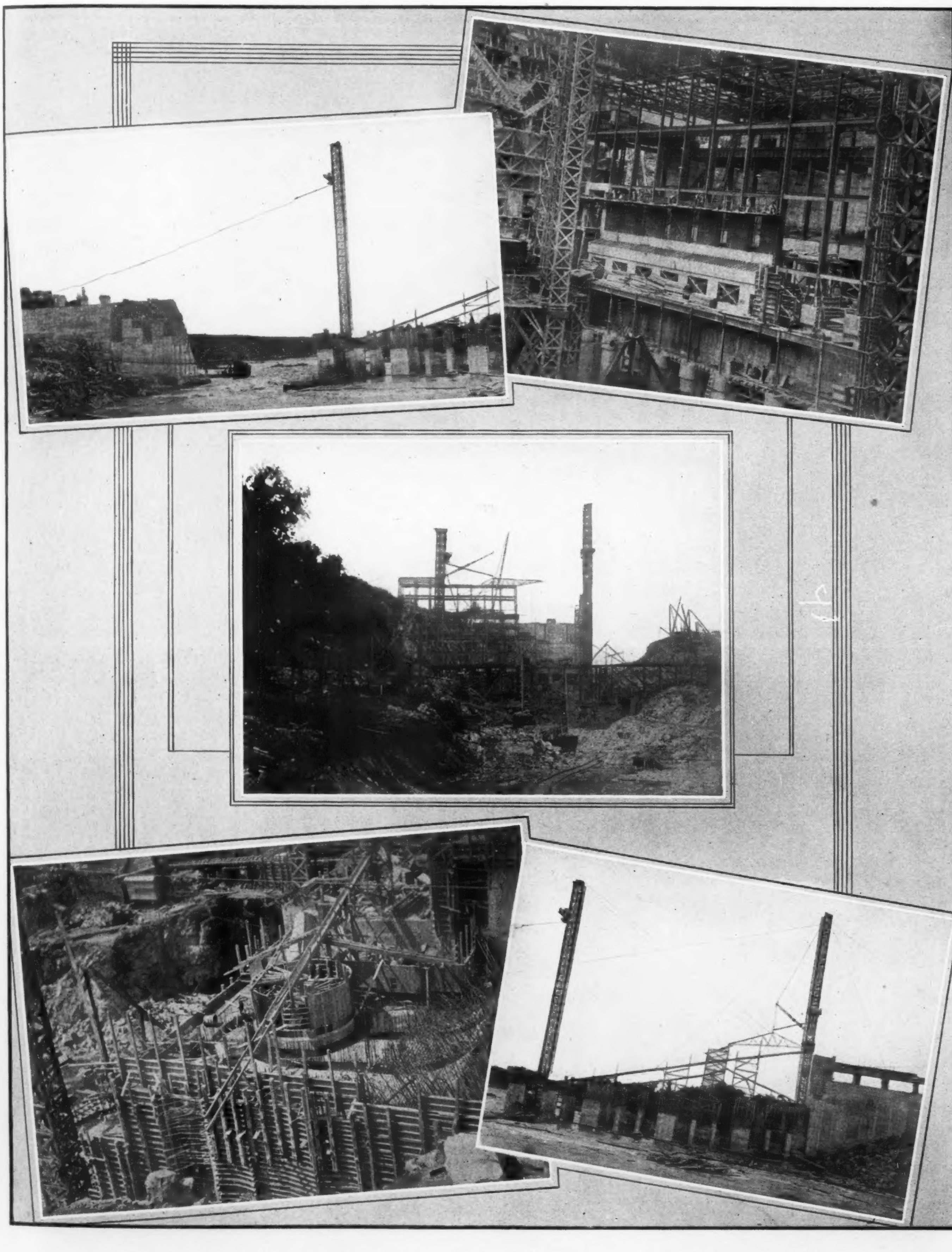
The total compressor capacity at Chelsea and Farmers Rapids is around 5,000 cubic feet of free air per minute. The Chelsea compressor plant consists of four motor-driven machines with an output of 2,717 cubic feet, while that at Farmers Rapids contains two units with a combined capacity of 2,293 cubic feet. The air is transmitted to secondary receivers, from which it is delivered to the various drills, sharpeners, pneumatic tools, etc.

The broken rock was handled by steam shovels and loaded into dump cars which were hauled by dinky engines to a central stone-crushing plant on each job. Substantially all the excavated rock was utilized in making concrete. Of the 156,000 cubic yards of concrete required at Chelsea, 85,000 cubic yards was used in the powerhouse and the balance in the dam, while 61,000 cubic yards of concrete was needed for the Farmers Rapids powerhouse and 107,000 cubic yards for the dam and related structures. There were central mixing plants at both Chelsea and Farmers Rapids, whence the concrete was distributed by 250-foot towers equipped with cantilever, counterbalanced chutes. Each of these plants mixed and delivered to the towers as much as 31,000 cubic yards of concrete per month.

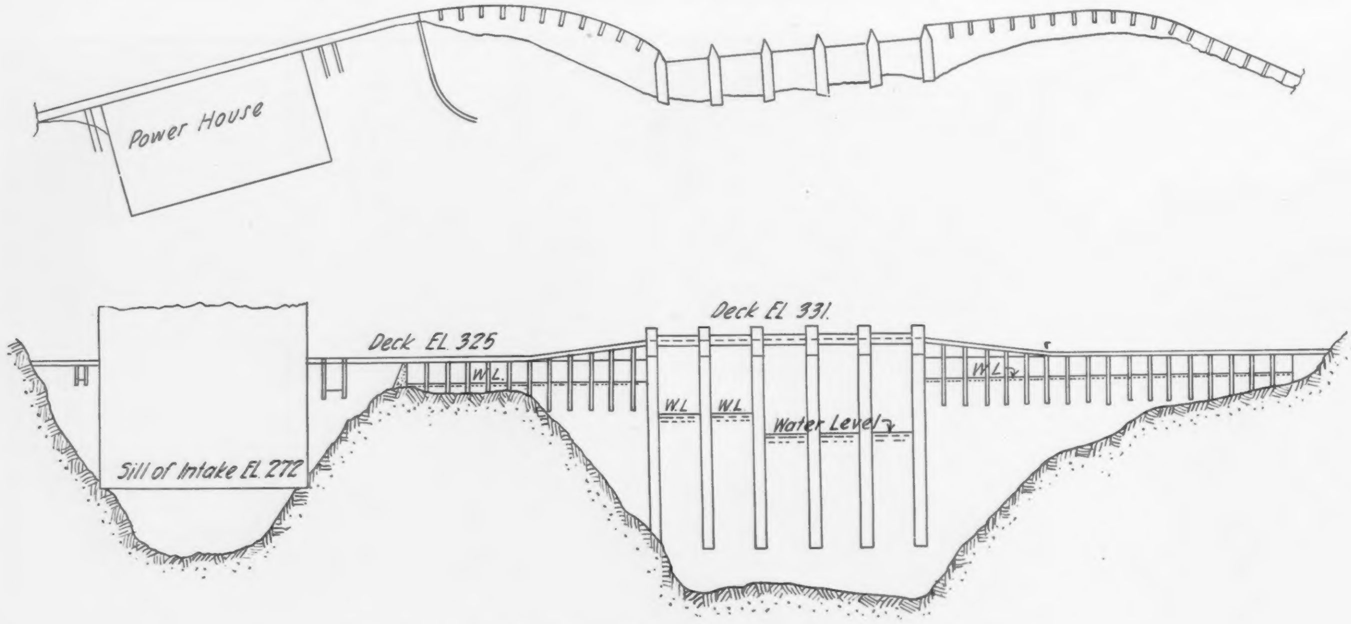
When one gazes at those ponderous hydroelectric plants and recalls that less than two years ago not a stroke of work had been done at either place, one has to pay tribute to the efficiency that can accomplish so much in so short a time. Metaphorically speaking, one has to take one's hat off to Messrs. Norris and McCarthy, the superintendents at Chelsea and Farmers Rapids, respectively, and to the responsible engineering staffs.

The Chelsea development was started October 19, 1925, and the first 34,000-h.p. unit was put in service January 4, 1927, or 13½ months later. At Farmers Rapids, work was begun January 15, 1926. At the end of 15 months the first generator unit was in operation. Considering the magnitude of the work and the

Left—Excavating for the tailrace at Farmers Rapids.
Center—Compressor house at Chelsea Development.
Right—Rock excavation for the tailrace at the Chelsea Development.



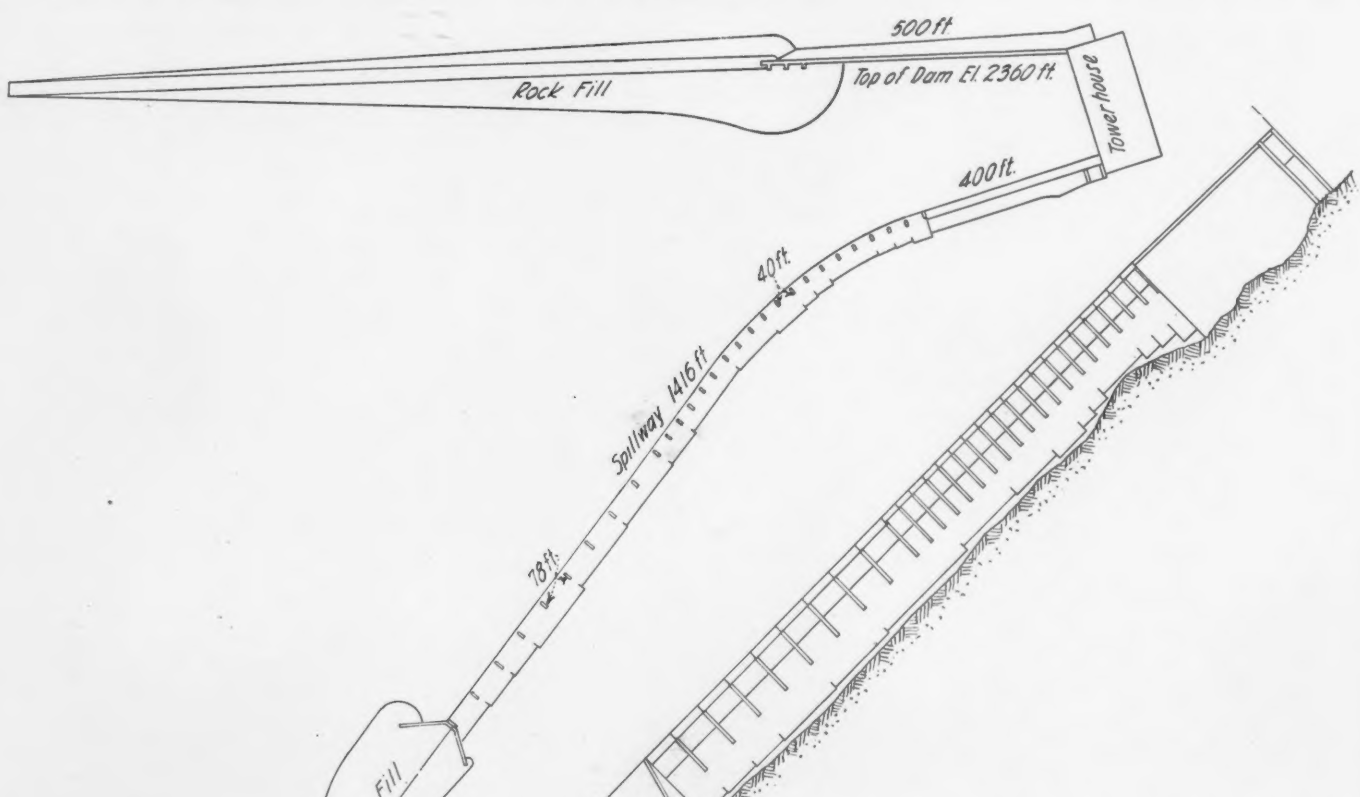
Various phases of the work during the construction of the dam and the powerhouse at Chelsea.



Plan illustrating arrangement of dam and powerhouse at Chelsea.

difficulties—such as cold weather, high water, log jams, etc.—with which the engineers were confronted, this is an astonishing record.

As one inspects the works with some of the genial and amazingly matter-of-fact engineers, the conclusion is forced home that those individuals must have nerves of iron. One walks along a narrow causeway that winds around massive piers and surreptitiously tries to determine how on earth it is stuck on. Below, the waters of the Gatineau River are gliding between two piers. The weight and the volume of the flow are so great that the surface is perfectly smooth; but downstream, a few feet away, the water breaks into a seething maelstrom that defies description! In the mind of the casual visitor, such as the author, there comes the thought: "Suppose this confounded gangway became 'unstuck' from its unseen moorings." Naturally, one's nonchalance is not bolstered up by such signs as: "Danger." "Heavy loads must not be carried on this gangway." One wonders what is meant by "heavy."



Plan of dam, spillway, and powerhouse at Farmers Rapids.

Courtesy, Canadian Air Force.

Top—Farmers Rapids Power Development as seen from aloft.

Bottom—An airplane view of the Chelsea Development.

There is an air of efficiency about the whole place. The conviction grows that everyone, from the engineers on down to the men at the hammer drills, the steam shovels, the mixers, and the multitude of other appliances, knows his job—in other words, that each one is a specialist. This applies with particular force to such figures as A. R. Graustein and his associates, who were able to visualize this vast structure and who had the power and the strength to give it form; to A. H. White, Chief Engineer of the International Paper Company, who could transform the vision into reality; and to the numerous technical men who are superintending the multitude of operations and who are giving permanence to what was only, at first, a dream.

At this point we may leave the hydro-electric phase of the operations and turn our attention to the pulp-and-paper works, on the Ottawa River, about 2 miles east of the Village of Gatineau Point. These works cover a large area and include slasher and barking mills, stackers for pulp blocks, a chipping mill for converting some of the blocks into chips for making sulphite pulp, a sulphite-pulp plant, a ground-wood-pulp mill, paper mills, and such incidentals as electric boiler plants, transformer houses, machine and carpenter shops, pumping and water-purification plants, executive buildings, and a probable town site. The pulp logs, cut on the company's lands and floated down the Gatineau and Ottawa rivers, will be taken from the water at one end of this great plant and turned out in the form of finished newsprint at the other end. In short, the whole process will be practically a continuous sequence of operations on an enormous scale.

On approaching the works, one cannot help making comparisons with the scene two years or so ago, when the region was a stagnant farming district and, to quote its own inhabitants, was "dead but not buried." Today, a town has sprung up to house an army of nearly 3,000 workmen. Great steel structures of all shapes are being reared. There is heard the steady clatter of pneumatic riveting hammers, the clanking of dinky engines speeding along on a maze of tracks. Huge piles of materials dot the countryside. A network of pipe lines for compressed air, etc., covers the ground; and a maze of overhead wires makes current available everywhere. Activities never cease. Thousands of electric lights turn night into day; and great searchlights throw their concentrated glare upon special jobs. The first impression as one overlooks the site is one of confusion: too many apparently disconnected operations unfold themselves before the eye. But, after a while, the separate activities take definite form, and confusion becomes coördination. Then comes admiration for the organization that can direct and keep tab on so many complex operations.

The work at Gatineau is under the superintendence of A. I. Cunningham, Resident Engineer of the Canadian International Paper Company, and of J. Menzies and S. Holmes of the Fraser-Brace Engineering Company, Ltd.

(To be concluded)

CARQUINEZ SPAN COMPLETED BY UNIQUE METHOD

WITH the pressing of a gold button, President Coolidge recently opened to traffic the great $8,000,000 cantilever bridge across Carquinez Straits, thus signaling the beginning of direct highway communication across San Francisco Bay. It has been estimated that, at the present rate of traffic flow, something like 1,000,000 motor cars will use the span annually.

The Carquinez Straits Bridge has a total length of 4,482 feet, a 30-foot roadway that can accommodate three motor trucks abreast, and two 4-foot sidewalks. It has a clearance above mean high water of 135 feet, which is sufficient to permit the passage of any of our battleships.

Aside from its bigness, the structure has created world-wide interest among bridge builders because of the manner in which two 450-foot spans, each weighing 750 tons, were hoisted 135 feet into position to complete the bridge. Instead of being raised unit by unit and thus made an integral part of the bridge structure, as is the common practice, these particular spans were assembled on a specially constructed dock nearby and floated from there to designated points beneath the bridge. This was something of a departure in bridge building; and the hoisting of the spans brought to the scene of operations engineers from far and wide to witness this stupendous feat.

It is estimated that more than 10,000 people —on the shore, and on tugs and launches—were present on March 4, 1927, when the first of the spans was successfully raised. It took just 4 hours and 15 minutes from the time the section was floated on to two steel barges, also especially constructed for the purpose, until the great 12x38-inch steel pins, each weighing 1,500 pounds, were shoved into place.

On that morning, the barges were floated under the span; and, by the aid of the tide and eight 500-ton hydraulic jacks, the load was transferred from the piling to those craft. After they had been towed to the scene of operations by four tugs, the two loaded barges were secured by heavy cables to four other barges. These vessels were disposed at the corners of an imaginary quadrangle for the purpose of bringing the span in line with the projected centerline of the bridge and of holding it directly beneath the gap to be closed. This work of anchoring had to be done while the tide was at flood! Now came the most ticklish part of the job; and the method by which the span was hoisted is unique in the annals of bridge building.

The span was raised by a system of four counterweights, each of which measured 13x13x21 feet and was filled with 200 tons of sand—representing a total weight something in excess of that of the span. To these counterweights were secured 2½-inch steel cables, with special steel cores, which were passed over 5-foot sheave blocks on the bridge and then fastened to the four corners of the span. Suitable drum hoists, with cables leading to the counterweights, were provided to control the lifting; and there was also an arrangement of blocks-and-tackle to maintain lateral control—that is, to prevent the span from rocking and tipping during its ascent.

After the cables had been securely attached to the span, and when the tide was about slack, the counterweights were released; and slowly but steadily the span began to rise. A number of stops were made to check levels and to make certain that all the lines were clear—a telephone system, branching out from a central place of command to every point of action, being of great assistance in this work.

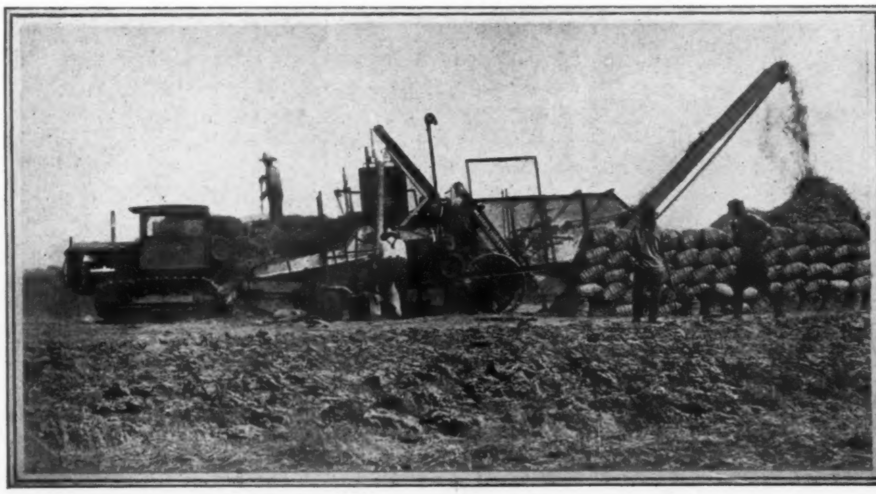
Just 48 minutes from the moment the signal was given to start hoisting, the great 750-ton mass of steelwork was in its proper place. Hazards faced the workers at almost every stage of the gigantic undertaking; but the plans had been so carefully arranged and so many precautions had been taken that the feat was accomplished without the slightest hitch or mishap.

For the convenience of pedestrians, a moving stairway is being built in Havre, France, on the site of the old Montmorency slope that involved a climb of 350 steps. From top to bottom the escalator measures 443 feet.

Four counterweights, consisting of timber boxes filled with sand, were used to hoist into position this 450-foot fabricated section, weighing 750 tons, so that it could be secured to the neighboring bridge sections already erected.

Compressed Air Serves Rice Growers In California Fields

By A. M. HOFFMANN


Tractor furnishing power to thresh rice in a California field.

SELLING rice to Japan sounds like "carrying coals to Newcastle." Just the same, rice grown in the United States is being exported to Japan, which has lately become an important factor in the American rice market. According to the Department of Commerce, more than 25,000,000 pounds of this cereal was shipped to that country during the first quarter of 1927—California rice, especially, being favored because of its similarity to the Japanese product. Rice culture in California is a new and promising industry; and credit for its introduction in that state is due to Prof. W. W. Mackie, in charge of cereal investigations at the University of California, at Berkeley.

In 1908, when Professor Mackie was connected with the United States Department of Agriculture and engaged in research work at the Biggs Experimental Station, Butte County, California, he conceived the idea of experimenting with the growing of rice in small beds at that station. So successful was the outcome of those investigations that he decided to operate on a scale large enough to prove the practicability of rice culture in the Golden State. From his knowledge of California soils, he ascertained that the region best suited to rice growing lay in the heart of the rich Sacramento Valley where there were available abandoned lands of heavy, "adobe" soil, lands that could be bought for as little as $5 an acre.

Further experimentation served to convince Professor Mackie of the correctness of his scheme. When he proposed to others the cultivation of rice in California on a commercial scale, he met with some scoffers, with some who were half-heartedly in favor, and with a few who were frankly enthusiastic. Thus there was organized, after a slow and uphill struggle, a group of men, under the leadership of Ralph P. Merritt, that later became known as the Rice Growers' Association of California.

At the outset, the thought of selling to a foreign market was farthest from the thoughts of Professor Mackie and his associates. The question which troubled those pioneers was: Could California rice be sold at home at a price that would enable them to compete with the product from Japan, where Oriental labor could be obtained for as little as seven cents a day? As they were faced, in some instances with the necessity of paying their workers a hundred times as much as that, and as the cost of labor in those days of the World War was steadily rising, their task seemed well-nigh impossible of accomplishment. But determination won the day; and they went ahead with their plans.

No small part of the success of the venture is attributed to the adaptation to rice culture of agricultural machinery used by our wheat growers and, likewise, to the application of compressed air. That machinery had to be utilized in order to meet competition was a foregone conclusion. Hand labor, at the prevailing wage, was out of the question. Track-type caterpillars were therefore put in service in preparing the soil—that is, in pulling the heavy gang plows employed to break up the ground. These tractors, despite the soft and yielding ground of the flooded rice fields, have proved well suited for this work and that of planting.

The crop flourished. Then came the harvest. This brought to the scene the caterpillars, har-

A tractor-operated binder harvesting rice in the Sacramento Valley.


Part of an extensive battery of binders at work in a California rice field.

This push binder does not break down the grain as would an ordinary harvester drawn by a tractor.

vesters, and threshers so common in our great western wheat fields. The first harvest was a success—the yield far exceeding expectations. But that first year taught the growers many things; and by improving methods of cultivation it was possible for them to produce rice at a still lower cost, in fact at a cost that enabled them to compete with the Japanese product. It was in the attempt to still further reduce production costs that compressed air entered into the field of rice culture. In brief, compressed air is now employed to operate scrapers or land levelers in preparing the soil for planting.

This use of compressed air has saved many rice growers a hundred and more dollars a day for days running, as it has made it possible for one man to do the work of two or more men each receiving as much as $10 *per diem*. The leveler, which is towed by a tractor, is controlled by the driver from the seat of his machine—the vertical position of the scraper carried by the leveler being raised and lowered, to suit the changing ground surface, by pistons operated with compressed air. A small compressor, driven by the tractor motor, serves to store the air in a tank from which it is delivered through a flexible hose to the leveler, as desired. It has been said that one man with a tractor and leveler can go over as much ground in a day as it would take a small army of coolies to cover in a month.

Not content with what he has already achieved, Professor Mackie has gone farther afield and revealed that the soil of the great Imperial Valley, in southern California—which has only recently been made fruitful through irrigation, is suitable for the production of rice. Whether or not this region may become one of vast rice fields, the fact remains that the rice-growing industry has come to stay in California. Last year, 125,000,000 pounds of rice, valued at more than $5,000,000, was produced on 150,000 acres in the Golden State. Of this total some 70 per cent. went to Japan—commanding the best market price because of its quality.

COUNTY HIGHWAY OFFICIALS FORM ORGANIZATION

THE American Road Builders Association, through its business director, Charles M. Upham, has just completed the organization of a national County Highway Officials Association, a body of local road officials representing each of the 3,070 counties in the United States. The new organization will start its work immediately, and will function similarly to the American Association of State Highway Officials.

There has long been a need in this country for an organization of just this sort, which is counted upon to do much towards preventing the wastage of county or township funds while helping to improve the nation's system of highways. In the past, with 3,070 separate political sub-divisions constructing and maintaining roads without technical intercourse or standardization, this wastage was inevitable.

Photo, Ewing Galloway.
Rotterdam, Holland, is one of the busiest grain ports in Europe. This picture shows a pneumatic plant for loading and unloading cargoes of this kind.

CHARLES FREDERIC RAND

CHARLES FREDERIC RAND died at his home in West Orange on June 21, bringing to a close a very active and an exceptionally useful life of 70 years. Mr. Rand was long identified with mining activities—his work in this field beginning in 1888. He was a past president of the American Institute of Mining & Metallurgical Engineers, and had been a chairman of the executive board of The Engineering Foundation. Besides owning iron mines in the Lake Superior district, he is generally credited with the discovery of large iron-ore deposits on the north coast of Cuba.

His eminent standing in his profession won for him numerous honors. In 1913, King Alfonso of Spain decorated him with the Grand Cross of Knight Commander of the Order of Isabella Catolica; and in 1922 he received the cross of Chevalier of the Legion of Honor from the French Government for his services during the World War. He was made an honorary member of the Iron & Steel Institute of Great Britain in 1921.

The passing of so conspicuous a figure will be recognized both at home and abroad as a distinct loss by his professional brethren and by those branches of industry to which his talents contributed generously.

INDIA PROMOTES USE OF BY-PRODUCTS

THE latest report of the Department of Industries of the State of Mysore, India, emphasizes the valuable work that is being done by the industrial chemist and the research engineer in finding ways and means to turn waste products into profitable channels. It should be of interest to our readers to learn what is being accomplished there through coöperation in promoting the utilization of by-products.

In the Mysore Ironworks a product has been made from scrap material that is suitable for the preservation of wood and iron. This preservation is now undergoing service tests; and, according to the Superintendent of Industries, is being very favorably reported upon by consumers. The man of the laboratory is also engaged in the manufacture of a new kind of flooring out of sawdust and certain chemicals. In another field, efforts are being made to turn silk waste into spun silk; and to this end a carding machine has been devised that is giving very encouraging results.

Yet another line of investigation that promises satisfactory returns concerns a large deposit of emery that has remained unworked because the material was considered useless. Now it develops that the emery from this source can be absorbed on the spot by the numerous rice mills that are located in Mysore. It has been determined through tests that the abrasive is admirably adapted for facing the cones employed in these mills.

The total production of crude platinum in the United States in 1926 was 286 ounces—115 ounces in excess of the purchases made in that twelvemonth by domestic refiners.

Quarrying Marble in Rumania

Methods and Equipment Employed at Ruskicza in Getting Out Dimension Blocks of Pink and White Marble

By J. BIBEL

IT was an axiom among the ancients that civilization, progress, and prosperity were impossible without art. The Greeks and Romans gave material evidence to this axiom by the ways in which they employed marble in architecture and statuary. Therefore, it should not be without present interest to learn of the methods and means by which marble is quarried for manifold purposes in picturesque Rumania.

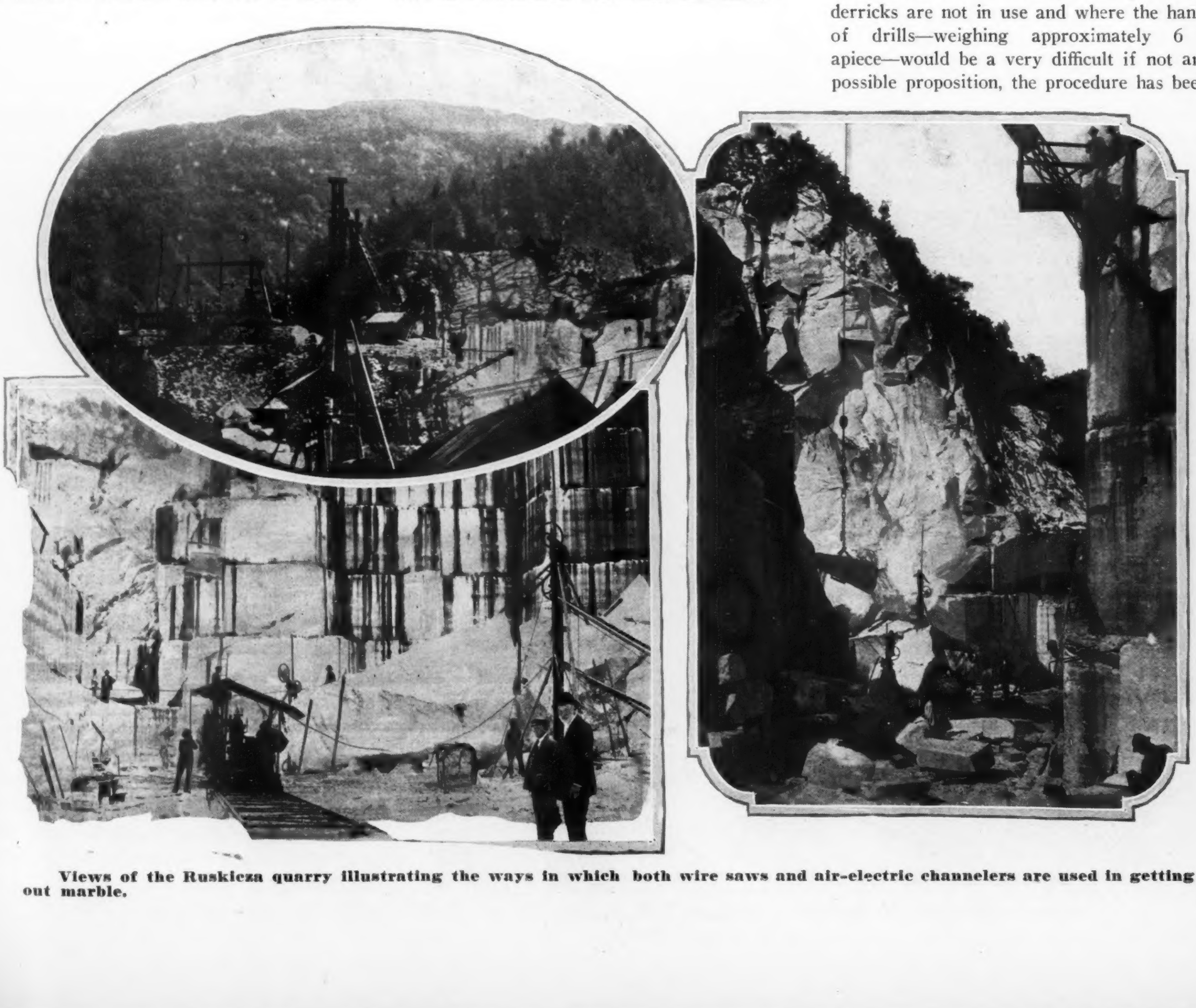
The beautiful marble quarried at Ruskicza is found in white and light-pink formations, and is admirably suited for architecture or for ornamental works of art. Owing to the fact that the crystals are somewhat larger than those in the famous Carrara marble, the grain of the Ruskicza marble is coarser and has a more lively or brilliant aspect. The stone has a specific gravity of 2.7 and a compressive strength of 11,947 pounds per square inch. It is free from iron, and is both frost and weather resisting.

In order to get out the marble by dimension-stone methods with the least loss in marketable material, blasting is not resorted to at Ruskicza. The marble is quarried entirely by mechanical means that make it possible to separate large blocks of the material from the quarry walls—cutting a series of channels to accomplish this. Although this procedure is generally considered a modern one, still it was employed by the ancient Romans. Then, however, the work was done by hand, and progress was slow, and the cost undoubtedly high.

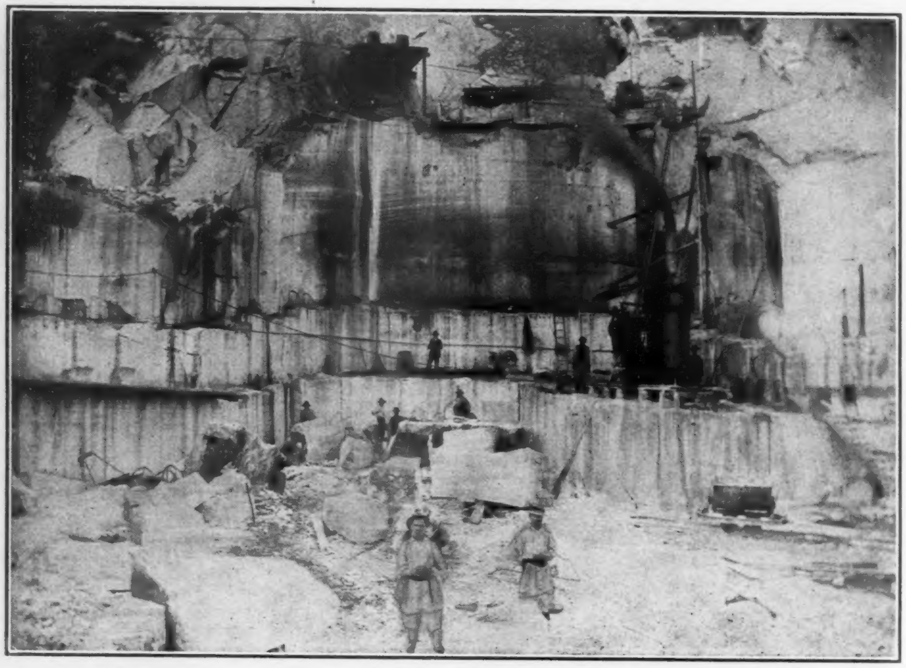
George J. Wardwell, in Rutland, Vt., was the first one to succeed in superseding handwork by machinery. In 1863 he had a channeling machine in operation in one of the Rutland quarries. True, his machine was subsequently surpassed by other channelers, but credit is due to Wardwell for his pioneer service in showing how machinery could be utilized. About 25 years later, Michel Thonar, in Namur, Belgium, brought out what is now generally known as a wire saw, devised to cut or channel stone by the abrasive action of wire in combination with water and sand.

Thonar's system has this disadvantage: it requires an open space at each end of the rock to be sawed in which a support can be erected to serve as a guide for the endless wire rope made up of three strands of wire 0.236 inch in diameter. The supports also are used to regulate the depth of the cut as the wire works its way deeper and deeper into the quarry wall. However, in most cases, only one side is open, and a well 35.4 inches in diameter has to be sunk in the rock to support the pulley carrying the endless wire at that point. For sinking a well Thonar employed an iron pipe 19.68 feet long and 35.4 inches in diameter—the lower part of which had a steel cutter. The pipe was rotated by rope drive; and by adding steel grit to the cutting action of the pipe it was feasible to excavate a rock core. This method has since been extensively utilized in Belgium, where the quarries are generally equipped with derricks. So much for what is common practice elsewhere.

In Carrara, and in many other places where derricks are not in use and where the handling of drills—weighing approximately 6 tons apiece—would be a very difficult if not an impossible proposition, the procedure has been, of



Views of the Ruskicza quarry illustrating the ways in which both wire saws and air-electric channelers are used in getting out marble.



A steam-driven channeler at work. Just above the steam channeler can be seen a Monticolo wire saw in operation.

necessity a different one. Monticolo, at Carrara, succeeded in overcoming this 6-ton handicap in a very interesting way. Briefly stated, he found that a hole 2.36 inches in diameter, made with a diamond drill, would suffice. Into this hole a rod was lowered that carried a guiding wheel over which the cutting wire traveled as it sawed deeper and deeper into the rock. In this manner, the weight of the shaft- or well-drilling apparatus was reduced from 6 tons to 661 pounds, and this much lighter equipment could be easily dismantled and moved from point to point as needed. Because of this innovation, the utilization of the wire saw extended rapidly throughout Europe.

Let us now distinguish between the European and the American methods of getting out dimension stone. I decided to introduce and to try out both of them at Ruskicza; and, after an experience covering a period of 45 years, I have found that in high mountains it is practicable to adapt both methods so as to effect operating economies. My quarry was started on a very steep slope of a mountainside at a point 656 feet above the lowest part of the valley. This was done in order to have sufficient room for a dump and to be able to work into the mountain and downward.

It was first necessary to make a platform before we could work with channeling machines moving along on rails. To make this platform we used four wire saws—two operating on the Thonar system and two on the Monticolo system. With these, cuts or channels were made about 65.61 feet long and 26.24 feet deep. This equipment was augmented by an easily shifted I-R "Broncho" channeling machine mounted on a quarry bar. This machine served to make shorter cuts up to 15.58 feet. Still lighter I-R rock drills—namely, the "D-24" and the "A-35," on quarry bars—were also utilized for channeling. The procedure was to drill holes close to each other and to broach the remaining bridges between the holes.

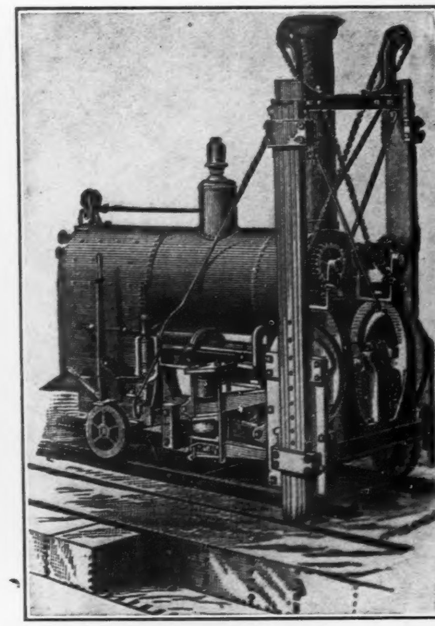
After having secured a large working platform in this way, we bought our first steam-driven channeler from the Ingersoll-Rand Company. We were so satisfied with this machine—an "H-9"—that we did not hesitate to buy two No. 7 electro-pneumatic channelers when that company brought out those machines. These newer channelers proved to be excellent machines. While the "H-9" steam channeler requires about 30 h.p. the No. 7 channeler, of substantially the same capacity, needs but approximately 14 h.p. The No. 7 permits the making of not only vertical cuts but it can operate on a slope of 45 degrees—a matter of much importance. Five years ago we added to our equipment a fourth electro-pneumatic channeler, a Type "F-10," capable of making an 8-inch cut. We use this in getting out the harder pink marble. For regular production, we employ the channelers exclusively, while the wire saws are utilized only to work into the mountain.

In channeling, experience has shown that the best length for a cut is from 32.8 feet to 39.3 feet, because on cuts of this length the steel bits are able to stand up and to perform well. Accordingly, the working platform is divided by longitudinal cuts in the manner shown by the accompanying sketch. Between these longitudinal cuts are made crosscuts which, instead of being run parallel, are slightly tapered so that the blocks will not be apt to jam when they are withdrawn. The longitudinal cuts are made in sections of 32.8x32.8 feet, as indicated in a general way on one of the sketches—holes being put down with an electro-pneumatic drill at a-a, b-b, and c-c to a depth of 14.76 feet, the usual depth for such cuts. Cutting could be done without these machines, but in that case it would cause a slight sloping at those points which would be somewhat objectionable. The cuts, themselves, are about 1.96 inches wide and are kept clean by flowing water. It is possible to keep the cuts clean without water; and we work dry without trouble in the wintertime. The blocks thus channeled or cut are wedged at the bottom and pulled over by means of winches. The cutting up of the blocks is done either with drills or with a wire saw.

From the quarry, a steam derrick lifts the blocks to any of the five stationary Thonar wire saws or to the inclined plane by which the blocks are moved to the gang saws—of which we have eleven at work. We have available 400 h.p.—principally water power and electric power—and a personnel of 150 workmen. With the machinery at our disposal we obtain the following results:

Where pink and white marble are quarried at Ruskicza.

Type of air-electric channeler that has proved so successful in the quarrying of marble.



Wardwell steam channeler that first supplanted handwork in Vermont marble quarries.

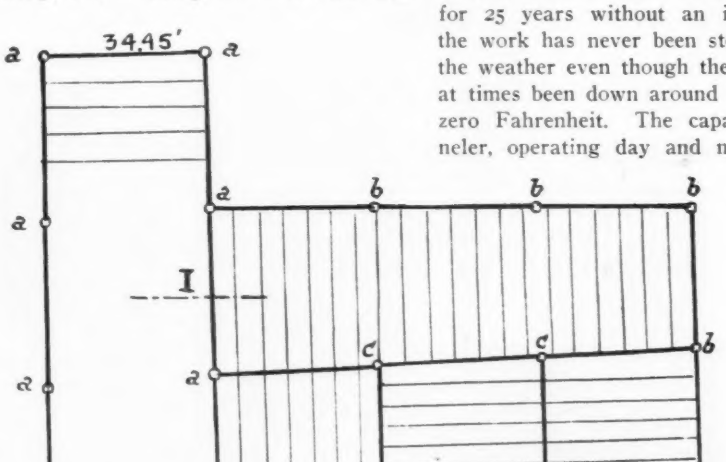
Cost of Channeling a Square Meter
(1.195 Square Yards)

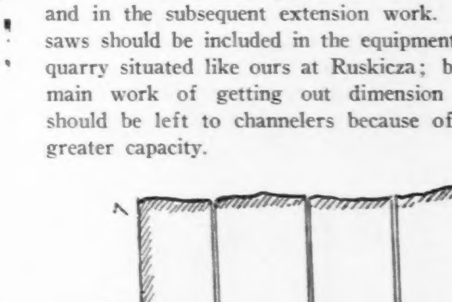
With the "Broncho" channeler mounted on a quarry bar	$5.14
With the "H-9" steam channeler	2.17
With the "F-10" electro-pneumatic channeler	0.54
With the No. 7 channeler	0.52

The wire saw, working in live rock, is capable of cutting 0.284 square yard an hour which, on the basis of power consumed, is at the rate of 0.071 square yard per horsepower-hour. Based on these figures, the cost of cutting a square meter, or 1.195 square yards, is $0.41. On the face of it, it would seem that sawing by wire costs less than channeling; but, in reality, this is not the case for several reasons. It is not possible to work with wire saws in the winter or at night. The marble quarries are usually situated in lonely mountain districts where the winters are long and where the halting of operations for a number of months would make it hard to keep a well-trained personnel. Furthermore, when using the wire saw, elaborate and somewhat extensive preparations are necessary for each cut. In fact, hardly more than 239 square yards can be cut during a year with the wire saw. The operating of several wire saws greatly hinders the general work about a quarry owing to the many wires that are required. Channeling, on the other hand, can go on night and day, summer and winter. Indeed, we have been channeling in Ruskicza for 25 years without an interruption; and the work has never been stopped because of the weather even though the temperature has at times been down around 10 degrees below zero Fahrenheit. The capacity of a channeler, operating day and night, is approximately 1,673 square yards a year, or seven times that of a wire saw. Production with channelers can be increased at will, as the machines can work close to each other or even on the same rails without disturbance or jamming—something impossible with wire saws in such close quarters.

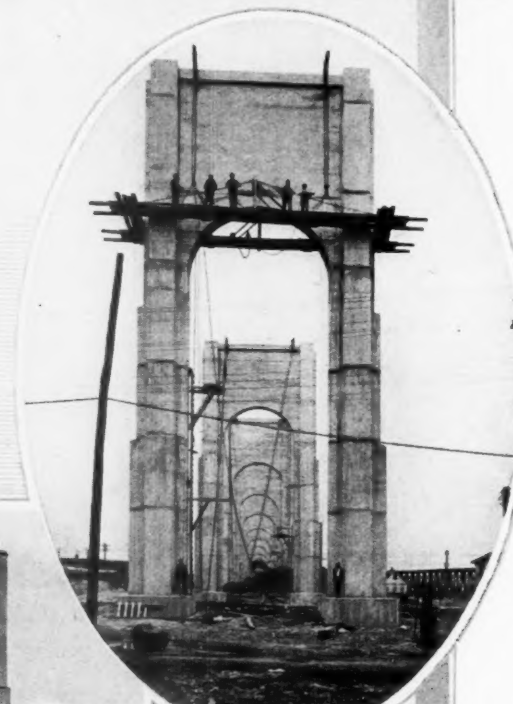
The only advantage that can be claimed for the wire saw is that its initial cost is hardly one-tenth of that of a channeler. This seeming advantage is, however, offset by the mobility of the channeler and its capacity to perform continuously. The higher first cost of the channeler is soon covered by the work done by it; and, after that, the machine is a source of profit. This is notably the case with the channelers used by us, which, being carefully designed, have given long service. Some of the machines in use now have been working for us steadily night and day for virtually 25 years, and all they have needed has been a few spare parts.

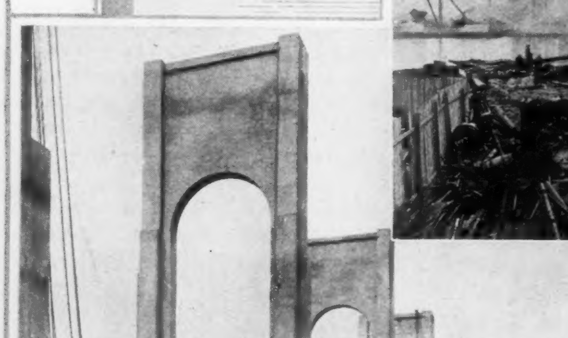
The wire saw will give excellent service in the necessary opening-up operations at the start and in the subsequent extension work. Wire saws should be included in the equipment of a quarry situated like ours at Ruskicza; but the main work of getting out dimension stone should be left to channelers because of their greater capacity.





Plan and vertical section illustrating the manner of making longitudinal cuts with air-electric channelers and of making crosscuts with air-electric drills to a depth of approximately 15 feet, as indicated at sections a-a, b-b, and c-c.





Air-driven surfacers are putting the finishing touches on the reinforced-concrete towers and approach piers of the bridge across Arthur Kill that will link New Jersey with Staten Island, N. Y.

Air-Driven Tools Make Concrete Appear Like Marble

CONCRETE can be given the outward appearance and the finish of cut stone. In fact, as most of us know, concrete is taking the place of cut stone in many directions because this plastic material can be molded in place and rapidly massed to meet a wide diversity of demands.

In order to give the surfaces of extensive masses the finish familiar in the finer examples of masonry, it is essential that the concrete receive the finish when in position. This can now be done with air-driven tools that were originally designed to surface stone intended for building or monumental purposes.

Stationary surfacing machines are commonly employed in stoneyards where dimension stone is turned out in quantity. These machines are utilized mainly in finishing broad surfaces; and, as a consequence, corners are rounded and other kindred detail work is often done by hand. It was to avoid this somewhat lengthy and more expensive handwork that portable, pneumatic surfacing machines were developed. These tools are an adaptation of a well-known type of air-driven grinders; and their comparatively light weight and ease of manipulation make it possible to do expeditiously many sorts of stone-finishing work.

Tools of this kind have been and can be used to advantage in finishing and in polishing granite, marble, and other stones; and, latterly, they have proved themselves notably efficient and economical in surfacing concrete structures of different sorts and of varying magnitude. An air-driven tool, such as is shown by the accompanying illustrations, can be fitted with either a ring-type grinding wheel or with a cutting head equipped with steel disks so that the machine can be employed to meet a wide range of conditions and materials. The free speed of the machine is 2,000 revolutions per minute.

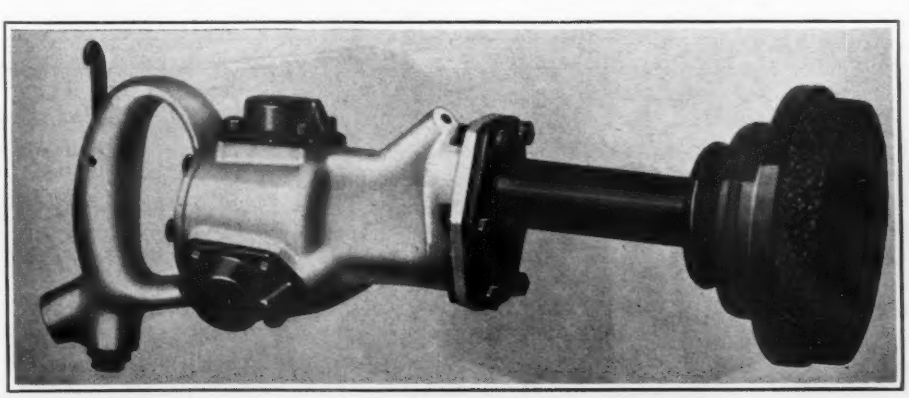
There is now in course of construction a monumental bridge that will span the Arthur Kill between Elizabethport, on the New Jersey side, and Howland Hook, on the Staten Island or New York side of that stream. The piers that will carry the span as well as the piers that will support the two approaches are of reinforced concrete, cast in position by successive pourings. The size of these piers can be best realized when one is reminded that the two piers on the opposite banks of the Arthur Kill are more than 100 feet high in order to insure a clearance of not less than 135 feet for shipping passing beneath the bridge at flood tide. The piers on the Staten Island side have been erected by the Frederick Snare Corporation, while those on the Elizabethport side of the Arthur Kill have been reared by the Triest Construction Company. The contracts specified that all form marks should be removed from the concrete so as to leave the surfaces perfectly smooth.

The extent of the task can be understood when it is recalled that the main tower and the associate approach piers on the New Jersey side of the stream have a total of 300,000 square feet of surface that must be finished in the manner just described. There are two kinds of irregularities that must be got rid of: the board marks left by the woodwork of the forms where in contact with the plastic concrete, and the bands or ridges produced at the junction points of successively poured courses of concrete.

The method employed by the contractors consists of removing the board marks with grinding wheels, while the rough bands of excess concrete are first dressed down with tools equipped with cutting heads and then the same machines are fitted with grinding wheels which give the concrete its final desired smoothness.

The grinding is done with the face of the wheel held in an especially prepared head that is driven through a fabric type of universal joint. This arrangement makes it possible to keep the wheel flat at all times against the surface undergoing treatment. The cutting head is made up of a number of star-pointed steel disks that revolve on radial axes carried in the head. With such a cutting head, high or rough spots can be rapidly reduced to the desired plane. It is difficult to understand how this work could be performed quickly and at a reasonable cost by any other means. The grinding wheels impart to the piers an appearance that, at a short distance, is much like that of smooth-finished marble.

It may interest some of our readers to know that for fresh or green concrete, where it is desired to smooth up or remove form marks, the grinding wheel is employed. Water is brushed on the surface previous to grinding when a finer finish is wanted. This wheel also is used to give a pebble finish. For concrete that has aged or taken a more permanent set the cutting attachment is utilized to remove form marks or high spots. A grinding wheel may be employed to give a finer finish after the cutting attachment has done its work.



Close-up of the I-R surfacer equipped with a grinding wheel.

THROUGH TRUNK HIGHWAYS FOR MOTOR TRAFFIC

TO attract foreign motorists, the Automobile Club de l'Ouest—the most active of the French organizations that are intent on promoting better highways—has announced a campaign for the improvement of automobile trunk roads between the Atlantic ports of France and the Riviera. In this work they are seeking the coöperation of the government, and the interested municipalities, tourist associations, and chambers of commerce. Three roads are immediately under consideration: Cherbourg-Nice, 760 miles; Le Havre-Turin, 705 miles; and St. Nazaire-Turin, 640 miles.

This is in line with the projected German-Swiss-Italian transcontinental automobile highways that are to link Hamburg and Stettin, on the north coast of Germany, with the Swiss and Italian resorts to the south. The longest of these two arteries, from Hamburg to Nice, will extend for a distance of 1,000 miles.

PAPER FROM ROPE WASTE

MANILA-rope waste is good paper stock. This conclusion has been reached as the result of experimental work initiated for the purpose of finding a profitable use for the refuse fiber of the cordage industry. While old rope has been employed in the manufacture of so-called "rope papers"—strong, tough material made into shipping tags, wrappers, bagging, etc.—little if any of the manila-hemp waste from cordage mills is put to commercial use. Most of it is consumed on the spot as fuel under the boilers.

The experiments that led to the discovery were conducted by the Government; and the refuse employed came from the rope walk at the Boston Navy Yard. This scrap material was successfully made into paper by the processes commonly used in the paper industry—soda ash proving the best digestive agent in turning the fiber into pulp. The product obtained is of sufficient strength to render it suitable for a variety of purposes.

CORROSION-PROOF DURALUMIN

FOR the past two years, the United States Bureau of Standards, in coöperation with the Army, the Navy, and the National Advisory Committee for Aeronautics, has been experimenting with duralumin in an effort to remove one serious drawback to the use of that aluminum alloy in airplane construction. It has been found that this alloy, particularly when exposed to salt air, may become brittle through a type of corrosion that is not apparent on the surface and that cannot be detected upon inspection. This corrosion, which is termed "intercrystalline embrittlement," weakens the bond between the crystal grains that make up the alloy.

According to an official statement based upon the laboratory work of the government experts, "the greatest drawback to long life and safety of duralumin for aircraft construction may be almost completely eliminated by means that are commercially practicable." The tests have proved, first, that by quenching the metal in cold instead of in hot water, as is the common practice, the resistance to intercrystalline corrosion is markedly increased. Second, by giving duralumin a protecting coat of unalloyed aluminum it is possible to obtain further insurance against corrosion. Commercially pure aluminum is not subject to intercrystalline embrittlement. Specimens of duralumin covered with aluminum by the metal-spray process have been exposed to salt air for a year, and are showing no signs of deterioration.

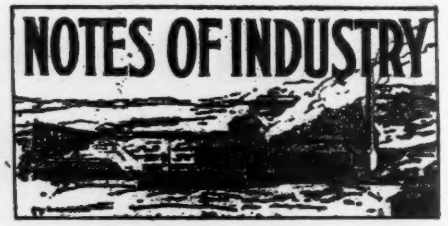
In this connection it is interesting to note that the bureau's experiments with aluminum-coated duralumin have been corroborated by independent laboratory tests. These tests were inspired by one of the largest manufacturers of duralumin, who is now producing sheets of the new metal on a commercial scale.

ELECTRIC FURNACE IN NEW FIELD

A NEW type of electric furnace has been devised that, if it comes up to expectations, may take the place of the kilns now used in roasting ores and in calcining limestone, gypsum, etc. According to the claims of the inventor, E. Halloway, of Melbourne, Australia:

The heat control of the furnace, which is of the rotating type, is perfect; the products of combustion do not come in contact with the material during the roasting; fines can be effectively treated; the carbon dioxide produced from limestone is pure and can be saved; no space is required for stocking or storing fuel; 95 per cent. of the heat is utilized as compared with about 30 per cent. in ordinary lime-burning operations; and it can be applied to the distillation of oil shales.

At the present time a furnace of this sort is being built for the treatment of limestone. This furnace will be 10 feet long and have an internal diameter of 2 feet.



Wool merchants and textile manufacturers of the Bradford district, England, have been working on a fabric to take the place of jute as an outside wrapping for bales of wool because the jute fibers get mixed up with the wool and cause trouble. The new material is composed of strands of paper twisted around a strand of unusually strong steel wire. Woolgrowers of the colonies are trying out the wrapping.

That certain of our eastern states contribute greatly to the mineral output of the nation is a fact generally little appreciated, and was stressed in a compilation of the mineral production of the United States, for 1925, recently made public by the Bureau of Mines.

Pennsylvania was in the lead, with coal, cement, clay products, and natural gas valued at $867,196,000; Oklahoma, California, and Texas came second, third, and fourth with outputs—mainly of petroleum—worth $501,767,000, $496,923,000, and $351,212,000, respectively. West Virginia ranked fifth, with yields of coal, natural gas, petroleum, and clay products valued at $333,528,000. Delaware was at the bottom of the list—her mineral production for the year having amounted to $539,000.

To promote public welfare, the Board of Health of Kitchener, Ont., has placed a ban on the use of natural ice except for refrigeration. That the public might be protected, all firms selling natural ice must notify their customers as follows: "On account of the findings of the Provincial Board of Health, this ice is to be used only for cooling purposes and must not be put in food or drink of any kind." Apparently, for all-around service, manufactured ice has been given the palm of hygienic superiority.

During the past few years Australia has gone seriously about the work of forestry development. The aim is to increase her present reserve of 11,000,000 acres of timberland to 24,500,000 acres. Based on her present population, this means 4.25 acres per capita.

Brazil has great water-power resources with convenient catchment areas that would lend themselves readily to damming. Of the 378 important waterfalls in that country only 154 have been surveyed. Roughtly estimated, these would be capable of producing at least 50,000,000 h.p.

According to a recent Music Trades Convention, 80 per cent. of the 10,000,000 pianos in United States' homes are out of tune. With this lack of harmony, how could the people be expected to act in concert.

From the *Engineer* we learn that there is in service in the transformer works of the Allgemeine Elektrizitäts Gesellschaft in Berlin, Germany, a newly developed plant that makes it possible to refine for re-use transformer and switch oils. By the process, the oils are not only treated with china clay or kindred substances, but they are subjected to regular refining—that is, the oils are treated with materials such as are employed in the refining of new oil. Transformer and switch oils that have become useless, and are acid and black, are thus made fit for further service at a saving in cost.

In July, 1926, the first shipment of 795,000 barrels of crude oil was made from Colombia. Now, a little more than a year later, Colombia is an important factor in estimating the world's production of petroleum. During the first four months of the current year a total of 3,329,276 barrels was exported mostly to the United States. It is claimed that the most promising of the oil-bearing fields are held by the state and have not yet been touched.

Gold retained its prominent position in the mining industry of South Africa during 1926, establishing a new record both in the matter of quantity and value of output. A total of 9,954,761 fine ounces was produced worth about $210,000,000.

The United States Bureau of Mines has been conducting a line of research at its Non-Metallic Minerals Experiment Station, New Brunswick, N. J., that promises to bring about substantial economies in the mica industry. In the manufacture of ground mica, losses are now sustained owing to the incomplete settling of fine particles in the wet-grinding process. As finely ground mica is worth anywhere from $100 to $120 a ton, the recovery of even a small percentage of the material now wasted would prove worth while. A solution of the problem has apparently been found, and lies in the employment of suitable electrolytes as flocculating agents.

The Exposition Internationale de Fonderie et Congrès International is to be held in September of this year at the Parc des Expositions, Paris, France. The exposition and congress are under the auspices of the Minister of Commerce and the Comité Francais des Expositions, with offices at 8 rue de la Victoire, Paris. All nations have been invited to send delegates to the congress; and the exhibits may include raw materials, products in course of manufacture, foundry machinery and tools of all kinds, drawings, descriptive material, etc.

The first section of the Glasgow-Edinburgh road, which is part of a national scheme to relieve unemployment in Great Britain, has been opened to traffic. This 1½-mile stretch forms an important link in the eastern end of the highway, and was built at a cost of about $240,000. It is estimated that the entire project will involve an expenditure of $10,000,000.

Compressed Air Magazine

—Founded 1896—

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EDITORIALS

WHITE MAN'S DISCOVERY OF OIL IN AMERICA

A FEW days ago, with suitable ceremonies, there was celebrated at the Village of Cuba, N. Y., the three hundredth anniversary of the white man's discovery of petroleum on the Continent of North America. As was preëminently fitting, representatives of the Seneca Indian Nation acted the part of hosts on that memorable occasion, because it was near Cuba that the Franciscan monk JOSEPH DE LA ROCHE D'ALLION was led by the Indians of that tribe, in July of 1627, to what has since been known as the Seneca Indian Oil Spring.

Three centuries ago the Indians looked upon that spring, which carried oil upon its surface, with both religious awe and reverence. The Indians anointed and greased their heads and bodies with the oil and attributed to it magical and curative properties. Indeed, the Senecas have for centuries watched over the spring; and a representative of that nation has lived near that source of oil throughout the intervening years for the purpose of maintaining tribal title to it.

To us of today, apart from the historical glamor that surrounds this particular spring, it is notable that the knowledge of that source of oil and of other springs of the same sort happened upon by white pioneers laid the foundation for an interest in petroleum that has gradually brought into being an industry of amazing magnitude and world-wide importance. Only a few miles away from the Seneca Indian Oil Spring is the oil-producing area of southwestern New York that is now yielding annually something like 1,000,000 barrels of high-quality petroleum.

Similarly, from the early awakening to the uses to which petroleum could be put has evolved the feverish activity and quest that has culminated in the Seminole field in a daily production of more than 400,000 barrels. Bent only upon spreading a gospel of peace and brotherly love among contending Indian tribes, Father D'ALLION probably never reckoned that his revelation about an oil spring in the wilderness would blaze the way to vast and momentous undertakings in the course of the succeeding centuries. At first we obtained only light from petroleum: today we are getting from it a tremendous measure of motive energy; lubricants that are indispensable to the wheels of industry; and innumerable derivatives and by-products that have well-nigh limitless applications.

NOISELESS TOWN

THE propaganda of cleanliness—the urge to make every community a spotless town—was very much with us a few years ago. Even though the gain was at best only relative betterment, still the public benefited in the end. Probably most of the material gains were made by the manufacturers of insistently advertised soaps and other cleansing preparations.

Now comes a newer campaign that has for its goal comparative noiselessness: the object being to reduce the tax on auditory nerves and to breed a calm in which the physically suffering and those of a contemplative mind may have an environment suited to their particular needs or bent.

One of the earnest leaders in this new movement is Dr. LOUIS I. HARRIS, Health Commissioner of New York City. The growing pains of the Metropolis—made audible in various ways—have aroused this official to action; and he has singled out for correction such outspoken manifestations as the racket of riveting hammers, steam shovels, blasting, etc. He would have these disturbers of the peace silenced and employ in their stead noiseless substitutes. To this end, Doctor HARRIS would first put the quietus on the riveting hammer that now serves to bind the framework of our continually multiplying and steadily mounting skyscrapers and kindred more or less indispensable structures. Accordingly, the Health Commissioner recently called together an aggregation of engineers to advise him how best to proceed.

The experts in question were as one in urging the adoption of welding as a satisfactory substitute for riveting—the experts differing only in the methods they would use to do the welding. One group was sure the electric arc was preferable; and the other group was equally certain that gas welding was distinctly superior. The virtues of welding were expounded at length; and, figuratively speaking, the rivet hadn't a leg to stand on when the conference came to an end.

Afterwards, Doctor HARRIS made this announcement—according to a news account in one of the Metropolitan dailies: "It was the concensus of the technical men that the practical value of welding and its safety in construction work are no longer a matter of speculation or experiment. It has been proved beyond any doubt that, given a proper design of the steel parts, and proper material for construction, and competent supervision of the method of welding, very large buildings can be erected to withstand all kinds of stress and strain." This is very promising; but the public still awaits fulfillment, because nothing of this sort and magnitude has yet been reared and bound together by welding.

Without in any way detracting from the fields in which welding has been usefully employed, we must not forget that there are other experts that are not in accord with those engineers that Doctor HARRIS consulted. Somehow, this guardian of Greater New York's health did not call to his council technicists long familiar with the virtues of riveted work. And, apparently, no one pointed out that the very men who urged the use of welding in the final stages of construction would employ fabricated steel units that owe their strength and suitability to their riveted bonds. The curious person just naturally asks: "Why interject another method of effecting the final union?" A chain can be no stronger than its weakest link; and we are not yet aware that the United States Bureau of Standards has stamped the welded building with its approval.

No one would regret if the riveting hammer could be muffled; no one would be sorry if the steam shovel only whispered where it now proclaims itself loudly and harshly; and no one would object if blasting could be done without a single note of violence. None of us would do anything but rejoice if the dentist could drill into our teeth without distress; but most of us recognize that this momentary misery is the best and shortest way to relief. The noises that Doctor HARRIS would hush are loud for the same reasons.

AMERICA IN THE AIR

WITHIN an interval of a little more than five weeks, the world was recently amazed by four trans-oceanic flights. Suddenly, general attention was focused upon aviation, and the populace was aroused to exceptional enthusiasm by the deeds accomplished that made little of far distances and did wonders in the way of stimulating international good will. The heartening aftermath of it all is that America —so often proclaimed backward in flying—has thus jumped into the very forefront of aerial navigation. For years to come LINDBERGH, CHAMBERLIN, MAITLAND, and BYRD will be names to conjure with and a source of pride to us.

Out of these several experiences certain significant things stand forth, emphasizing the progress made and pointing to things that must yet be achieved if long-distance flights of a kindred nature are to become matters of daily occurrence in the course of the next few years, as some of these distinguished airmen freely proclaim.

It is evident that engineering skill has produced motors capable of providing the needful power and able to operate continuously for many hours at a time. Designers have evolved types of aircraft that can make effective use of

motors of this sort. The flying fields and the various air services are turning out men of courage and of expertness peculiarly fitted for such work aloft. What next is most urgently needed are agencies that can be relied upon implicitly to guide the aerial navigator surely to his objective even though his landing place be obscured by fog and his route be similarly shrouded for long periods during his flight. The blinded air pilot is in a peculiarly perilous situation because he cannot poise aloft and conserve his fuel as might a ship resting upon the ocean and similarly hampered by the weather. The aviator must come down before his fuel fails him lest he crash to earth and to well-nigh certain death.

The four flights in question have contributed a wealth of invaluable information; and in its scientific aspect and the fund of potentially helpful data, BYRD's flight, although ending nearly in disaster, will prove especially rich. The men concerned have unquestionably advanced by years the cause of trans-oceanic aviation.

AMERICA COMES OF AGE, by Andre Siegfried. Translated from the French by H. H. and Doris Hemming. A book of 358 pages, published by Harcourt, Brace & Company, New York City. Price, $3.00.

IN this book the author discusses the problems confronting the United States. Ethnically, those problems are more complicated than those that have confronted any other nation at any time. During the past 20 years immigration has included 40 nationalities, three-fourths of them Slavish. "The fusion of Anglo-Saxons, Slavs, Latins, and Jews is still far from complete." The presence of 10,000,000 negroes and the fear of the immigration of Asiatics make the problem acute in the extreme.

Fusion is still further retarded by the injection of the religious issue. Politics is seen to be primarily a struggle between religious and race groups, though here we have the paradox of a reversal of these groups within the same major parties in different parts of the country.

Of mass production the claim is made—with which we will hardly agree—that workmen are becoming automatons. "They—the Americans—do not worry about the disappearance of the artisan, and the regrets of a French individualist on this score seem quite incomprehensible."

Our economic structure receives much praise and little criticism, though our ability to long maintain our unquestioned supremacy is doubted. The book is worth reading, for the reactions upon the author of processes and events are often very different from the reactions of those of us whose viewpoint is essentially from within. H. B. M.

PROFIT SHARING AND STOCK OWNERSHIP FOR EMPLOYEES, by Messrs. G. James, H. S. Dennison, E. F. Gay, H. P. Kendall, and A. W. Burritt. A volume of 394 pages published by Harper & Brothers, New York City. Price, $4.00.

THIS book is the outcome of a jointly made comprehensive investigation of the subject of profit sharing. The purpose was to mark out the scope of profit sharing to determine its limitations and the results which might be expected, and to discover the most effective ways of applying the profit-participation incentive.

As the authors correctly say: "The profit motive is a strong force. It may well be utilized in some one of its manifold forms as an agent of efficient management and of social betterment. But the point of this book is not only that it can and should be so used, but that its application demands an understanding of its principles and an analysis of the situation it is meant to fill." Executives in many departments of our business and industrial life will find this compendium a help to them.

VENTILATION OF MINES, by Walter S. Weeks, Associate Professor of Mining, University of California. An illustrated book of 228 pages, published by McGraw-Hill Book Company, Inc., New York City. Price, $3.00.

THE price of metals must rise if more efficient methods of mining are not employed. Inasmuch as the cost of labor is the largest single item in the cost of mining ore by underground methods, it logically follows that everything practicable must be done to increase the efficiency of the laborer. This can be achieved by making his working places safe, healthful, and reasonably comfortable so as to attract men to that field of effort. Ventilation can be counted upon to contribute to a marked degree to these desired ends; and Professor Weeks has set himself the task of pointing out to mine managers how proper ventilation can be assured. His book is likely to prove a welcome contribution to this important service.

BUSINESS WITHOUT A BUYER, by William Trufant Foster and Waddill Catchings. A volume of 205 pages, published by Houghton Mifflin Company, Boston, Mass. Price, $2.00.

THE authors of the work are widely known because of their previous collaboration in the writing of their earlier books, *Money* and *Profits*. In *Business Without a Buyer,* Messrs. Foster and Catchings have essayed to present in a popular way the substance of *Money* and *Profits*.

Readers of the two earlier books have not always been able to follow the argument advanced dealing with the question of overproduction; and the authors have deliberately set about clarifying the situation by pointing out that their intention is to make a distinction between general overproduction and specific overproduction. Or, as they explain: "Our main argument . . . is not concerned with the means of preventing maladjustments of supply and demand in the cotton industry, or in the tire industry, or in any other industry; but with the means of sustaining the demand for the output of industry as a whole; that is to say, the means of perpetuating 'good times.'" We believe that *Business Without a Buyer* will be found enlightening and readable by a great many people earnestly desirous of a better understanding of an economic problem of the first magnitude that concerns everyone sooner or later.

SILVER CITIES OF YUCATAN, by Gregory Mason with a preface by Dr. Herbert J. Spinden. An illustrated volume of 340 pages, published by G. P. Putnam's Sons, New York City. Price, $3.50.

THE archeologist is finding much worth his while in the Western Hemisphere, and the peoples of Pan-America have every reason for interest in what is being progressively disclosed concerning the races and the nations that long ago flourished upon our neighboring and united continents. Of the work that has been latterly done in this field of exploration and investigation, none is more interesting than that of the Mason-Spinden Expedition to Yucatan.

Deep in the thick jungles of Central America are scores of ruins that bear evidence to the splendid cities that once flourished there, and that were abandoned centuries ago when the civilized race that called them into being mysteriously vanished. Mr. Mason's book reads like romance, and every page of it abounds with interesting matter.

STANDARDS YEARBOOK, 1927. Compiled by the National Bureau of Standards. An illustrated work of 392 pages, sold by the Superintendent of Documents, Washington, D. C. Price, $1.00.

THIS is the first time that the Bureau has issued in the present form a volume of this sort, and the innovation is a wise one that will be widely welcomed. "The *Standards Yearbook* represents an effort to present an adequate picture of the diversification and ramification of the standardization movement which has spread throughout the world with astonishing vitality during the 25 years that have elapsed since the establishment of the National Bureau of Standards. It contains outlines of the activities and accomplishments of not only this bureau and other agencies of the Federal Government and the States and municipalities, but also of the American societies and associations of which standardization is a major or very important activity.

"The *Standards Yearbook* will be most valuable in the daily work of all officers and agencies concerned with standardization. . . . It will furnish the answers to a great volume of urgent inquiries received by the Bureau of Standards from manufacturers, industrial experts, engineers, and purchasing agencies both governmental and general."

In the new laboratory of the Minnesota Highway Department, at the University of Minnesota, there is an interesting moist curing room where samples of roadbuilding materials may be tested over long periods of time and under varying conditions. This room is equipped with a high-pressure coil for steam heating, an automatic temperature control, and an improved type of atomizer operated with compressed air. Air at a pressure of 50 pounds per square inch is fed directly from the university's main line to the nozzles of these atomizers, which expel the water in the form of a fine spray.

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